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The Geographical Journal

Vol. LXIII No. 6 June 1924

ON THE WESTERN FRONTIER OF THE SUDAN

Capt. P. K. Boulnois, M.C., R.E.

Read at the Meeting of the Society, 7 April 1924.

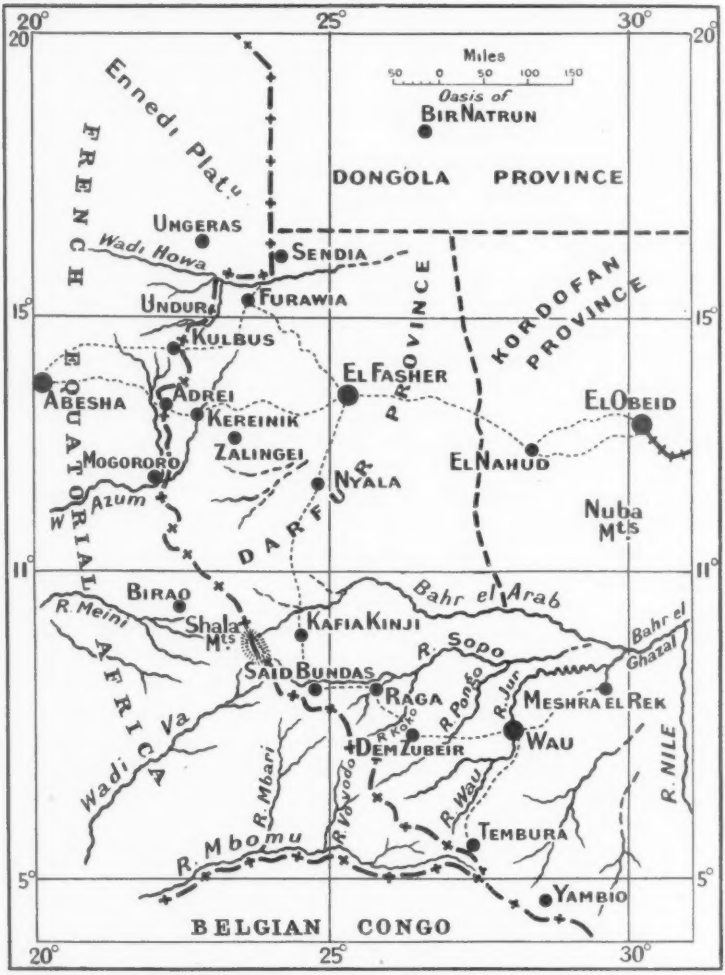
NOW that the boundary between French Equatorial Africa and the Anglo-Egyptian Sudan has been definitely decided, a few geographical details and a brief account of some experiences gained in mapping parts of that very lengthy frontier may prove of interest.

The Belgian Congo, French Equatorial Africa, and the Sudan meet at a point on the Nile–Congo watershed in lat. 5° 1′ north and long. 27° 26 east. This point is where the river Mbomu, the Franco-Belgian frontier, cuts the Nile-Congo divide, or, to be more exact, where the prolongation of the valley of the river runs up into the watershed. The Anglo-French frontier is then defined as this Nile–Congo water-parting for some considerable distance northwards, and on leaving this physical feature the boundary has been fixed in such a way as roughly to divide the tribes of Darfur from those in the French province of Wadai.

The southern parts of this frontier, where the boundary follows the watershed, are covered by thick forests which decrease in density as the line runs northwards, until the terrain becomes more of a bush desert than a forest. This bush desert, also in gradually decreasing density, continues along the whole western frontier of Darfur until a broad sandy watercourse, known as the Wadi Howa, is reached. The boundary follows this wadi from west to east up to the point where it is crossed by the 24th meridian of eastern longitude, and it then turns up this meridian and follows it for 260 miles northwards to parallel 19° 30′ north. All this part of the boundary north of the Wadi Howa lies in true desert, amongst sandy wastes which have been aptly described as "miles and miles of absolutely nothing."

At lat. 19° 30′ north the boundary turns north-westwards to reach another "three-boundary point" where the third country involved is Tripoli. From one three-boundary point to the other is about 1600 miles, but mapping operations did not extend over the whole of this distance. Except for some fixings of latitude and longitude at the northern extremity, the frontier maps that have recently been made by French and British surveyors extended only from the river Mbomu to

the Wadi Howa, or roughly from lat. 5° to 16°. This stretch of frontier is however nearly 1000 miles in length, and the mapping of it was naturally a task of considerable magnitude. It was accomplished in about



Western frontier of the Anglo-Egyptian Sudan.

eighteen months' work, but not without a good deal of difficulty and, what was worse, at the cost of two valuable lives. Colonel Pearson, R.E., the head of the British Mission, died at Um Dafog in December 1922, mourned by every one who knew him; and at the very completion of the

work Major Gandiche, the medical officer of the French party, also succumbed.

The French and British parties which undertook the mapping of this 1000-mile frontier reached the scene of their labours about Christmas 1921. Their route from Khartoum was *viâ* El Obeid, the railhead of the Sudan Government railways, and El Fasher. From El Obeid to El Fasher, the capital of the province of Darfur, is 370 miles, and as the road is fairly well known it need not be here described. A little less than three weeks on camels suffices for the journey, which is dull and uninteresting except for the first time that it is made, when the novelty of relying on water stored in the trunks of Tebeldi trees is calculated to interest the new-comer.

El Fasher is a centre of commerce, and in itself an interesting place, but after a month's stay there the survey parties were on the western road again. Twelve days' journey brought them to Kereinik; and from there a short camel ride led them to Adrei, a French post on the frontier, where their reception was more than cordial. Adrei was chosen as the starting-point of the frontier mapping, and one party was detailed to work southwards, while to the other, whose journey will now be described, was allotted the task of surveying from Adrei to the Wadi Howa in the north, a distance of about 200 miles.

The whole of this portion of the boundary lies in flat bush desert studded with small hills or "jebels." Usually these jebels are isolated, and in general they are only a few hundred feet above the level of the surrounding plain, but they are invaluable to the surveyor who wishes to make a map by triangulation, for they serve as sites for beacons and enable him to obtain good views over all the intervening country. Thirty miles north of Adrei there is a group of these hills—Jebel Kudri —3800 feet above sea-level, and again further north, a few miles south-west of the large village of Kulbus, there is quite a range of "jebels" whose highest peak is called Ungurru. This latter point stands 4100 feet above sea-level, and from its southern slopes rise the various wadis which form the sources of the large Wadi Azunga upon which the post of Adrei stands.

These wadis are all very similar in this region. Usually they consist of a well-defined sandy bed along which the water flows, more or less torrentially, during the rainy season or "kharif," and parallel to this main bed there are frequently smaller sandy channels. The bush, always thick except in the more northerly regions of Darfur, grows in great density on the banks of these watercourses, and it is no easy matter as a rule to make one's way across these thick belts of vegetation consisting chiefly of thorn bushes, when moving, as a surveyor often has to, off native paths. In the beds of the wadis, bone dry though they are for ten months of the year, water will usually be found by digging a well 15 feet or so deep. The natives grow their crops of "dura" and sometimes of

cotton or tobacco on the banks of the wadis, and generally site their villages close to them. The country, especially between Jebel Kudri and Kulbus, and again between Undur and the Wadi Howa, is sparsely inhabited, and not much was known of either of these parts before the mapping was undertaken, so that the business of locating every village, however small, and of finding all their wells was no light task.

The largest village on this part of the frontier is Kulbus, which lies to the north of the Masalit country and just inside Tama territory. It is an extensive collection of huts pleasantly situated amidst hills, and it has been for some years the headquarters of Sultan Idris of the Gimraui tribe. The surrounding country is fairly thickly populated, and the tribesmen own large herds of sheep, goats, and cattle. Kulbus itself stands 3000 feet above sea-level, and this figure represents the general height of the desert plain.

North-western Darfur is a healthy region. In general the mornings are cool and the nights at times distinctly cold. In January, for instance, two or three blankets are necessary, and an overcoat is wanted up till nine or ten o'clock in the morning when camel-riding. In the middle of the day the temperature naturally rises considerably, and in May and June the thermometer will show as much as 110° or 112° in the shade, but the heat is dry and therefore not too trying.

Game is scarce in this bush desert, with the exception of gazelle. Kudu were seen in the Jebel Kudri neighbourhood and again on the Ungurru hills. Giraffe and ostrich were occasionally sighted, and towards the Wadi Howa they became numerous. Lion were neither seen nor heard anywhere in the north except at Undur.

Undur is perhaps the most interesting feature in this northern stretch of otherwise somewhat dull country through which the boundary passes. It is the name given to a large "rahad" or lake which most curiously exists in this extremely arid and deserted region. Lake Undur is about 2 miles long and averages 500 yards in width. The water is not deep—only 2 or 3 feet at the time that it was first visited in May 1922. It is, however, most remarkable thus to come upon a large stretch of open water in a locality that is singularly waterless. The rahad dries up completely about the end of May, and no amount of digging in the bed of the lake when dry will reveal any water below the surface. Bird-life abounds round the confines of this desert lake, and many are the herds that are brought there to water by the surrounding tribesmen of Dar Kabja, Tama, and Zaghawa.

From Undur to the Wadi Howa is 75 miles along the boundary, and the country is even more waterless than that to the south. Trees practically cease to exist, and such vegetation as there is consists largely of thorn bushes of that particularly virile type known locally as "kiddar."

The boundary reaches the Wadi Howa *viâ* the Wadis Tini and Bahai, neither of which show many suitable points at which to dig for water.

ON THE 24TH MERIDIAN

TYPICAL WELLS ON THE FRONTIER

THE WIRELESS SET.

CAMEL TRANSPORT ON THE FRONTIER

SULTAN IDRIS OF DAR GIMR

THE WELLS OF SENDIA

Howa enjoys a certain amount of local notoriety, which is merited, for the wadi is, compared with others in the vicinity, of very great width and of importance as a grazing ground for camels. There is no very definite central bed in the Wadi Howa, but a series of small channels carry the rain-water from west to east during the wet months of the year. From south to north these channels and the comparatively luxuriant vegetation which they support stretch for nearly a mile.

As has been already described, the boundary leaves the Wadi Howa at its junction with the 24th meridian of eastern longitude, and follows that meridian northwards to parallel 19° 30′. An attempt was made by a small party to survey this meridian by rough methods before the rains had set in. Leaving the Wadi Howa, the first day's march northwards took the party to the very last wells that so far as is known exist in this region—those of Sendia, which lie a little to the east of the meridian. At these wells water sufficient for six or seven days was loaded on to camels, and the party resumed its march along the meridian. Very few miles north of Sendia all vegetation of any kind ceases. The sand becomes soft and difficult for rapid movement. Great dunes formed by the drifting sand appear, and not even a friendly thorn bush offers shade from the burning sun. Four days were occupied in the march northwards, and by the use of wheel and compass a rough idea of location was obtained. The photograph of open sandy desert shows this small reconnoitring party at the most northerly point that it was able to reach, some 80 miles away from the nearest water, and it represents a scene typical of all this absolute desert north of the Wadi Howa. The return march was accomplished in three days, and, owing to errors in the compass traverse, the party came back to the Wadi Howa considerably to the west of the Sendia wells, and in consequence spent the last day of the march on reduced water rations; but the reconnaissance had established the fact that normal mapping methods would be impossible north of the Howa owing to the lack of high ground and of water.

All this northern mapping, with the exception of the reconnaissance up the 24th meridian, was carried out by triangulation and plane-table resection, for which the country with its many scattered "jebels" is eminently suited. Two hundred and fifty miles' length of boundary was so mapped in a little over five months by a party of four white men and one Sudanese effendi. All transport was by camel. The supply of grain and food generally was naturally somewhat of a problem in such a country, but even so was of little difficulty compared to that encountered during the subsequent season's mapping.

For this second season it was decided that the surveyors who had been at the extreme north end of the boundary should map the section that began at the extreme south, that is from the point of junction of the Belgian Congo, French Equatorial Africa, and the Sudan. They did not however begin the work there, but chose a starting-point on the boundary

in the neighbourhood of Said Bundas, in the Bahr el Ghazal Province, and from there worked south-eastwards to finish at the three-boundary point. To reach this new starting-point some of the party travelled the long road back to Khartoum and so up the White Nile to the Bahr el Ghazal, whilst others trekked stolidly 600 miles through Kereinik and Nyala to Kafia Kinji where the reunion took place.

To get to Kafia Kinji from Khartoum means a good six or seven weeks' journey *viâ* Wau, the capital of the Bahr el Ghazal. Wau can be reached by steamer during some periods of the year, when there is enough water in the Jur river. Unfortunately the fact of there being enough water for the steamers—flat-bottomed Nile boats though they are—means that the rains have hardly finished or are in progress in the south of the Sudan. The 300-mile road from Wau to Kafia Kinji may at these times be consequently extremely wet. The road will be a liquid marsh, and there will be difficulties in getting across the swollen rivers of all sizes—"khors" as they are called, especially when there are no ferry-boats.

These were the conditions that marked the Wau–Kafia–Kinji road in October and November 1922, when for the second time the western frontier of the Sudan was approached. A "happy Christmas" was spent at the village of Said Bundas, surely one of the most out-of-the-way spots for such festivities. The time there was largely spent in obtaining a value for the longitude of the chief's hut, with a view to commencing the second season's boundary survey.

A wireless receiving set had joined this southern survey party, and throughout the work its aid was invoked for the determination of the position of all main points on the boundary. Time signals were picked up from the Eiffel Tower, Lyons, the Lafayette station near Bordeaux, and from Nauen (Berlin) and combined with astronomical observations for local time, and for latitude, the position of the Nile–Congo watershed was gradually and accurately determined.

In the description of this famous divide which follows it must be remembered that only a portion is referred to: that from a point where a track leading due south from Said Bundas crosses it to the "three-boundary point" that has already been several times mentioned. Along this stretch of the divide it would be no exaggeration to say that one's average limit of vision is 20 yards or so. From the intersection of the Said Bundas track to about lat. 7° 30′ where the Khor Koko has its source, there are a few scattered "jebels"—granite peaks as a rule—both on and near the actual watershed. But from Khor Koko south-eastwards all high points cease entirely. The divide is not "a flat tableland" with "occasional granite outcrops" as it has been sometimes described. It is a winding line in the flattest of flat forests. The forest is very thick, although the trees are not high, and the ground between trees is filled by the toughest and most prolific grass imaginable. From the commencement of the rainy season until well on into the year this grass is

so thick that any movement away from a properly cleared path would be impossible. Luckily nature has provided the sun, and about the end of November and the beginning of December the grass becomes sufficiently dry to be burnt. A chance spark igniting the dry grass will start a great forest fire, and in fact throughout December and January these fires will be in process wherever one looks, if from one of the rare hills one is in a position to watch over the surrounding forest. Survey operations had very naturally to wait upon these forest fires, and the mapping and discovery of this part of the watershed was not begun until the new year had commenced.

To find a watershed and to survey it in such flat country is by no means easy, nor is the task rendered any simpler by the survey personnel available being extremely limited, and the time at one's disposal short. The party whose work will be briefly described consisted of two white and one native surveyor only, assisted by a wireless-telegraph operator, who on occasion was called upon to help in mapping in addition to his wireless duties.

Plane-tabling being out of the question, it was decided to map the watershed by long traverses carried out by compass and with the assistance of cyclometers on wheels for measuring distances. Such traverses would of course be of no value unless brought to stations whose positions could be stated with great accuracy. It was here that the use of a portable wireless receiving set for the reception of time signals came in, and at every 40 miles or so along the divide a station would be established where wireless and the stars gave the longitude and the latitude.

One of the three surveyors available occupied himself entirely with finding by these and other means the geographical position of the control points for the other two men's traverse sketches. One man undertook the task of discovery, and, when discovered, the surveying of the headwaters and actual sources of all streams and waterways which by information, inspection, or inference flowed towards the Nile or any of its tributaries. The other surveyor dealt in the same way with all streams flowing towards the Congo river. Thus the latter surveyor (called the "French sources topographer" in the sketch) would strike out on a compass bearing into the trackless forest and continue on that bearing, for perhaps a full dāy's march, until finding nothing in the shape of a stream he might alter course and begin searching to the south. On reaching a stream (perhaps not 6 feet wide even) it would be incumbent on him to carry his wheel and compass traverse up that stream or up any of its small tributaries that he might discover until he came actually to the source of each. As a rule these sources of streams were merely marshes, but on occasion a spring would be found at the actual head. To say definitely which way a stream was flowing when first reached was not always as easy a matter as it sounds, for the water in these Nile and Congo tributaries within a dozen miles or so of the marshes which give them birth

proved usually to be practically stagnant. A stick thrown in would not move, and often careful search up and down the stream for some sign of water movement would reveal nothing. On these occasions the theodolite would be used as a level pure and simple, and so the direction of flow obtained. Having satisfactorily discovered a group of the precious sources, the surveyor would then have to strike out again to find more, but on occasion he would choose a compass direction which led him unwittingly over the great divide, and the next stream that he came to might well prove to be one flowing towards the Nile. Wearily he would then have to bend back his tracks to search in the forest for some "French" river, and so carry on the good work of "source discovery."

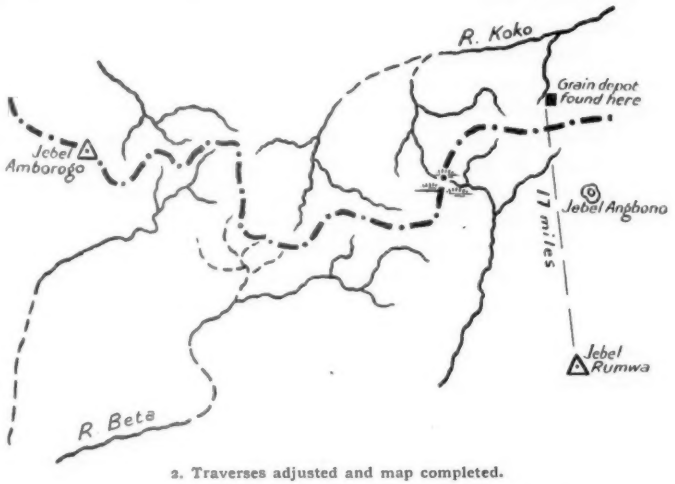
After, say, about 80 to 100 miles of this traverse work the surveyor might find that he was nearing the point on the divide at which it had been previously settled that a control point should be fixed. In the

1. Traverse with compass and perambulator by "French sources" topographer.

absence of maps of any kind the exact location of this control point was in nine cases out of ten unknown to the two detail surveyors. It had been decided possibly to site the station at or near the source of some river which, miles away from its source, was shown on existing maps and which therefore had a name of sorts. One says purposely "of sorts," for one of the greatest difficulties on the watershed was to reconcile the many different names that the few natives who had visited the neighbourhood of the divide would give to one and the same stream. On other occasions the control point might have been selected at a given distance and bearing from the previous one, and the two surveyors exploring the sources of the streams would therefore have on their field sheets the rough plotting of where the new control point might be established. Knowing then that his traverse had reached the approximate neighbourhood of the forward station, the surveyor would bend his course so as to endeavour to cross the tracks of the man who had moved straight from point to point with the wireless receiving apparatus, and

having found the track in the dense forest it would then be an easy matter for him to follow it and so reach the common meeting-point of all three surveyors. His compass and wheel traverse would of course be maintained along this "run home" so that he could obtain a plotting of the forward control station as determined by his traverse work.

When each of the two men doing source discovery had reached the control point, it was an exciting day for all, seeing how their traverse work agreed with the true position of the control point as found by astronomical latitude and by wireless longitude, or by another method that was employed in the earlier part of the work, namely "latitude and azimuth." Adjustments of the traverse would be made, and the resultant "map" was something of the form of Sketch 2. As will be seen, there



2. Traverses adjusted and map completed.

was not a stream that had not been surveyed in this somewhat rough way, and the dividing line of the water-parting could then be told with considerable accuracy. Armed with this preliminary map it was then an easy matter for any one or more of the three men to return to any portion of the divide where matters seemed in doubt, and to clear up any question as to the lie of the line of boundary. In fact, returning along the path in the forest made by a string of thirty carriers, followed by possibly a score of laden donkeys, was sheer joy compared to the slowness and difficulty of forcing one's way through the forest on a virgin line whose direction was determined solely by compass. One did not have to hack a path, it is true, but there were always small trees to be cut down, fallen bamboos to be cleared, and ways down cliffs to be found when compass-marching.

Unfortunately, on some occasions a surveyor doing the preliminary traverse work in the totally unknown forest would overshoot the line of

the forward control station selected, and on turning his march to find the all-important track leading to it would wander on and on, and find no sign of his confrère. There was nothing for it then but to "cast" and direct his march in ever-widening circles until, four or five days after he had first meant to bring his march to a close, he would cross a track and follow it to the meeting-point.

Supply was naturally a considerable problem on this portion of the Sudan frontier, though not an insuperable one. Grain depôts were established by the local authorities at previously selected spots in the watershed forest, but to know approximately where a grain depôt should be and to find it by the seemingly simple means of discovering the tracks leading to it are rather different matters.

At the beginning of the second season the transport of the party consisted of donkeys, bulls, and porters. It would have been easier if all baggage could have been carried by porters, for any more unsuitable a transport animal than a donkey when a party is moving away from all cleared roads and paths it would be hard to imagine. Carriers, however, cannot be supplied in unlimited numbers from a region which is so sparsely populated as is the western district of the Bahr el Ghazal. Bulls are a very good form of transport, as they can carry considerably heavier loads than donkeys and require no grain to be specially provided for them as their fodder. They are also a little less susceptible to the bites of tse-tse flies. Their one disadvantage is that each bull requires the services of a native as driver, whereas as many as six or more donkeys can be herded along a path by one man. One says advisedly "along a path," for when it is a case of driving donkeys in the wake of a string of carriers in a close-growing forest there is no limit to the number of men whom one would wish for to help pick up the fallen loads and even to lift the donkeys themselves over the unbridged streams. On many occasions when close to the divide the whole march would be held up several hours whilst each load was removed from its donkey's back, carried across a stream or marsh on one of the porter's heads, and the gentle moke himself lifted over the water.

Each donkey requires two pounds of native grain a day if he is to be kept in condition, and this grain must be carried when passing from depôt to depôt. Every driver or carrier requires the same amount of grain, and as much meat as he can possibly get in addition, so that a great deal of time had necessarily to be spent in shooting game to keep the many hundreds of followers fed.

Buffalo abound all along the Nile–Congo watershed, and many a herd was encountered during the wheel and compass traverse marches. Jackson's Hartebeest are also very abundant, and of other species Roan Antelope and Waterbuck were the most in evidence. Harnessed Bush Buck and Giant Eland were also met with. The forest is scarred by elephant tracks, but only on rare occasions were any of these animals seen. An

elephant track is a perfect godsend when one has been marching for hours through bamboos or through unburnt grass, but in this compass work little use could be made of them to hasten one's progress, for the elephant unfortunately does not maintain a constant magnetic bearing, as was the difficult duty of each of the surveying parties. The native too seemed to find difficulty in keeping a perfectly straight line of march when leading a column through the trackless forest, and it was necessary for the white man to get down from his mule almost every ten minutes to check the compass line.

It was not until the neighbourhood of Gubere, a large French village 70 miles only from the three-boundary point, was reached at the beginning of May that habitations of any kind were met with. There are in fact no villages within about 30 or 40 miles of this part of the Nile–Congo watershed on the Sudan side, and none within 70 or 80 miles on that of French Equatorial Africa. With the exception of a somewhat disused path leading southwards from the large village of Raga, the chief centre of the western district of the Bahr el Ghazal, to Jema well within French territory, there are literally no native paths crossing the divide. A few hunters' tracks were all that were seen in the course of four months' or more journeying down the watershed.

From the neighbourhood of Gubere onwards one comes to veritable "civilization," the most important place being the Yubo sleeping-sickness camp, which is within a few hundred yards of the boundary and which lies about 20 miles south of Tembura (see sketch-map). This Yubo camp is a marvel of organization and efficiency, and though the patients at the camp are far more numerous than one would wish, there is no doubt that early treatment and administrative measures for ensuring regular inspection of the non-infected inhabitants are having great success in the campaign against the disease. The least that could be done to show gratitude to the medical officers in charge of this hospital camp was to fix for all time the latitude and longitude of their position. A large boundary beacon was built after the wireless time signals had been received, and yet another point on the Nile–Congo watershed had been accurately determined.

From the source of the Yubo river to the final point that it was required to reach is only 40 miles. The forest proved much thicker along this stretch than it had been further north, and the trees bordering the numerous small streams were in particular of very much greater size and height than those that had been seen so far. That great rarity of the watershed an upstanding hill or two was also met with. Approximately this part of the forest is 2000 feet above sea-level, whereas at the starting-point of the mapping work near Said Bundas it is 2730 feet.

Arrived at the three-boundary point the difficulty remained to say exactly where the prolongation of the river Mbomu cut the Nile–Congo divide. To do this it was necessary to make considerable clearings of trees, and

for the first time recourse was made to obtaining levels so that the point should be as accurately determined as possible. Seven nights were spent in obtaining longitude, and eventually a cairn of stones some 15 feet high was erected to mark the point.

Six months had sufficed for the mapping of 370 miles of the watershed, but those six months were far from pleasant, for the climate in these regions is very trying. This is not due to any great heat, but to the damp and to that dire enemy of health, the malarial mosquito. Attacks of fever constantly interfered with the survey work, and the white members of the party were possibly rendered more liable to these attacks by the complete lack of fresh milk, fruit, and eggs. Normally a traveller in Africa moves along native paths and through their villages, and he can usually rely upon a supply of eggs and skinny chickens; but when working in uninhabited and trackless forest even these aids to comfort and to health are lacking. The rainy season in the southern parts of the Bahr el Ghazal lasts from about April to November, with occasional showers earlier in the year. Unfortunately for the survey the 1923 rains started considerably earlier than usual, and practically the whole of March was a wet month, whilst one heavy rainstorm swept the divide as early as February 10. The rains made matters much more difficult, not so much owing to the discomfort which they caused as to the uncertainties of clear and cloudless nights when stars could be observed. Even sun observations became impossible over a series of three or four days, and any one who has had experience of astronomical methods of survey will realize how greatly this hindered the mapping. Thunderstorms during the rains are quite a revelation in their intensity, and casualties amongst the native porters were twice caused by lightning. A tent is poor cover during such storms, and rarely stands up for more than a few minutes when the rain begins.

From the "three boundary point" to the Nile is a long journey of over 400 miles, and it was made in easy stages *viâ* the large villages of Yambio, Meridi, and Yei, at all of which there are Government officials and therefore the kindest of welcomes. It felt very "civilized" travelling along broad cleared paths with bridges over the streams, after so many months of moving on a compass bearing through the forest; and Yambio, which was the first port of call, seemed a veritable paradise of comfort. The rains were not so intense during May and June as they had been earlier in the year, and it was decided to take a cross-country route from Meridi to Yei rather than to follow the normal route to the Nile at Amadi. This track from Meridi leads through the village of Kheiralla, reputed to be one of the best centres for elephant in the Sudan, and is very little used owing to sleeping-sickness restrictions; but it certainly proved the better way to the Nile, for at Yei there is a service of motor lorries which runs regularly to Rejaf. The ninety odd miles between these two latter villages can in consequence be covered in one day

THE LAKE AT UNDUR

THE GRAIN CONVOY

A FERRY-BOAT NEAR RAGA

THE THREE-BOUNDARY POINT

BUILDING A BOUNDARY BEACON

DONKEY TRANSPORT IN DIFFICULTIES

instead of necessitating about five as it would if porters were still being used. The road is very well made, and girder bridges have been provided over the larger streams. Rejaf is the terminus of the Upper Nile steamer service, and ten days is enough for the down-stream journey to Khartoum. A very weary party of surveyors reached Rejaf at the end of June, and the labours of mapping parts of the western frontier of the Sudan were over.

Before the paper the PRESIDENT (the EARL OF RONALDSHAY) said: We are to be conducted this evening to a little-known part of Africa where the French possessions in that continent march with the Anglo-Egyptian Sudan. The demarcation of the boundary was a long and difficult task, and we may congratulate Captain Boulnois on having successfully survived the difficulties and the dangers of his journey, and having carried out a large piece of work during the eighteen months in which the surveyors were in the field. We are already indebted to Captain Boulnois for a most interesting technical paper, in which he told us of his experience of the use of wireless telegraphy as an adjunct to field methods. To-night he is to give us a more general description of the work of the expedition and of the country which it traversed. You can form some opinion of the great hardships to which the members of the expedition were subjected when I remind you of the lamentable and tragic fact that the officer at first in command of it, Colonel Pearson, died at his post. And, indeed, Captain Boulnois himself was a considerable sufferer from the hardships of those eighteen months. He has given me a graphic description of how he travelled the last 300 miles away from the scene of his labours on an improvised stretcher which took the form, as far as I could gather, of a wheelbarrow pulled by two stalwart porters and supported by an equal number behind. That will give you some idea of the difficulties and the hardships which were encountered by the party, and we may indeed congratulate them upon the success which ultimately crowned their labours. I now call upon Captain Boulnois to give his account of those eighteen months of work.

Captain Boulnois then read the paper printed above, and a discussion followed.

The PRESIDENT: There are not very many who can add much from personal knowledge to the lecture which we have heard to-night, but Sir Charles Close has had a great deal of experience on boundaries in Africa, and I will ask him to speak.

Sir CHARLES CLOSE: I should like, first of all, to congratulate Captain Boulnois on the really excellent lecture he has given us. He has described with a great deal of humour what is very often an uncomfortable experience—that is, the demarcation of an international boundary—and I can speak from experience gained when marking out one or two boundaries myself. I am perfectly sure, however, that in marking out a boundary with the French there were no difficulties with the other commissioners. When sitting in a room like this one is apt to forget what conditions in Africa really are. To make a lecture of this sort really topical you should, first of all, raise the temperature to about 100°; then let loose into the hall all manner of insects; then, if possible, introduce African smells, and then give everybody here a touch or two of fever! When you have done all that you have only begun to appreciate the difficulties of working in Africa. Then you might find that lecturing was

easier work than surveying. Captain Boulnois said they exchanged latitude and longitude for a certain number of pineapples. That was not a bad exchange. I remember in India a distinguished geographer was asked by an Indian civilian what was the good of knowing one's latitude, and he did not know, on the spur of the moment, what to reply. He said, "It is so nice to know one's latitude"! I suppose there is a sort of æsthetic pleasure in knowing it, but as a matter of fact if you do not know your latitude in Africa it may be rather serious.

Captain Boulnois referred to the difficulty of finding the watershed. It happens that a great many of the frontiers in Africa run along watersheds. There is the Nile–Congo watershed, and also the Congo–Zambesi watershed, equally—perhaps more—important, which runs through very much the same type of country as that over which Captain Boulnois travelled. It is not quite so forest-clad, but nevertheless is country in which it is very difficult to find the exact line of the watershed. In some cases the line goes through flat swamps, known in that part of the world as *dambos*, which though perfectly dry in hot weather are swamps in the rains. Those various methods which the lecturer has described of finding the position, and which he said were not quite orthodox, are in my opinion perfectly legitimate. I do not think there is such a thing as orthodoxy or unorthodoxy in exploring work. What you have to do is the best you can under the circumstances. I am certain that we all agree that Captain Boulnois did his best, and very well, too.

Colonel H. S. L. WINTERBOTHAM: The President has told us that there are none who can add to the happy description to which we have listened. We can, indeed, only envy Captain Boulnois and wonder why we continue, with courage, to sit on our dull London stools. But there is a point which is interesting in connection with this lecture, and which is always cropping up in connection with demarcation. It is such a pity that we should always have to put the cart in front of the horse. If one wants to study delimitation thoroughly it is obvious that the first necessity is a really good map, and a knowledge of the various peoples who live on one side or other of the frontier to be. Unfortunately, in preliminary discussions of a boundary that map and that knowledge are not available, so that almost invariably the cart gets in front of the horse. In regard to this particular frontier, the second of the two Conventions which govern it stated that the boundary was to follow northwards, until it reached the 11th parallel of latitude, the watershed between the Nile and the Congo. When the Commission actually got to the ground it was found that there was a third factor which had not previously been known. There is a river, the Shari, which runs to Lake Chad and introduces itself, as it were, between the Congo on the one side and the Nile on the other. A situation of this sort might introduce a considerable amount of difficulty. Fortunately, in this case no troubles did actually arise; but it is reminiscent of a little episode on the Afghan–Russo–Turkestan frontier. The frontier was to run through a certain spot on the Oxus named in the Convention which was drawn up in London. When the actual Boundary Commission arrived it was found that the place had been washed away, and so the Commission spent an anxious time in trying to find it!

The PRESIDENT: I am sure that you will wish me to convey to Captain Boulnois, on your behalf, your gratitude for a most entertaining and also a very instructive evening. Captain Boulnois has painted a picture of the Western Sudan which is very different from that which most of us had conjured up in our minds before we had heard the lecture. The task of finding

the Nile-Congo watershed must certainly have been a Herculean one, and when he described by means of his diagrams the devious ways that had to be pursued by those unfortunate surveyors in finding the sources of an enormous number of streams before they could actually find the watershed itself, I could not help calling to mind the well-known case of a man searching in a dark room for a black hat which was not there. The task of Captain Boulnois and his colleagues in their search for the Nile-Congo watershed was very much of that kind. I can say, with every confidence, that this audience of Fellows of the Royal Geographical Society has appreciated immensely the great pleasure which Captain Boulnois has given all present this evening.

NATURAL RESOURCES IN RELATION TO THE ARTS

C. E. N. Bromehead

Read at the Meeting of the Society, 10 *March* 1924.

SINCE many of the arts and crafts involve the use of rocks and minerals found in the Earth's crust, it is clear that the distribution of such substances in nature must to some extent influence the development of those arts. The study of the distribution of rocks and minerals is a part of geology, and a geologist may therefore hope, without undue presumption, that his notes on the subject indicated by the title of this paper may be of some interest to those whose knowledge of the arts may far exceed his own, but who have never looked at them from a geological point of view.

The influence of the geology of a country on its music is probably nil and on its literature small and indirect, though no one familiar with the bleak and sinister aspect of the Millstone Grit moors of West Yorkshire could fail to find its reflection in "Wuthering Heights." The painter makes use of many pigments of mineral origin, but the quantities used are so small and so easily portable that the localities where they are found have not been specially connected with the history of pictorial art. The ochres, however, require little or no preparation, and their extensive use characterizes all primitive painting, such as the palæolithic cave paintings of Spain and Southern France or the early wall-paintings and papyri of Egypt. But it is with arts more directly dependent on mineral substances for their material—architecture, sculpture, and ceramics—that this paper is intended to deal.

Architecture.

Perhaps the most primitive form of building is the construction of a shelter from materials which are brought together and arranged in order without any alteration of their form; the "Black Houses" of the Scottish Isles, built of boulders and blocks of stone collected from the

surface may be mentioned; a more curious instance is the use of basalt columns in the Caroline Islands to form structures resembling at first sight piles of logs resting on each other at right angles. But such building cannot be called or be said to have evolved into architecture, which implies an æsthetic aim beyond mere utility. The earliest architecture of which we have any real knowledge belongs to the great civilizations of Mesopotamia, Egypt, and Greece, and the development in each has been largely dependent on the materials available.

In an alluvial plain, such as that of the Tigris–Euphrates or of the Nile, stone is absent and timber scanty, but the mud can be dried in the sun, or later baked artificially, to form bricks. The most noticeable feature of a brick architecture is due to the physical character of the material. The crushing strength of a sun-dried brick is rather low; to combine height with stability a wall is, therefore, built wider at the base than at the top. The shape in which a brick is naturally made suggests a simple form of ornament. The surface of a wall in which the bricks are laid as stretchers (lengthwise to the surface) is broken up by bands, vertical or horizontal, of projecting headers. The ancient ruins of Mesopotamia show this characteristic batter of the walls, with simple buttresses separating sunken panels. Brick was exclusively used throughout the history of the civilization; stone was so rare that sockets for doorposts cut from this material were gifts fit for kings and were inscribed accordingly.

Most of the ancient Egyptian buildings with which we are familiar are of stone brought from exposures some distance up the Nile valley, but the style of the architecture is clearly derived from the use of brick. We see this even in the districts where stone is available on the spot. As civilization advanced up the valley the old style, evolved in the alluvial tract, was reproduced in the more durable material. This point has recently been elaborated by M. Capart, who traces the origin of numerous details of structure and decoration. Many of the temples show the batter of the walls characteristic of brickwork. Frequently a doorway in a stone wall is flanked by painted stripes representing wooden frame posts used in a way comparable with our half-timbered houses. He specially mentions the fourth-dynasty tomb of Prince Merab, in which wood panelling is imitated in stone. The pointed arch is unknown; many stone "arches" are formed by successive corbelling, the projecting corners of the stones being rounded off. Both the corbelled and the semicircular keyed arch have their probable origin in brickwork. Bundles of papyrus stems that can only have supported the lightest structures, perhaps of straw-plait, have been copied on an enlarged scale in the most usual form of the Egyptian column.

We have noticed that in Lower Mesopotamia the architecture was essentially brick. In Egypt a brick architecture was translated into stone. Greek architecture is very different. In Greece stone is abundant,

including the finest marble, and much of the country is well wooded. The more easily worked timber naturally precedes stone as a building material, and therefore in Greece the most typical architecture, the Doric, is a translation from wood into stone. The point is so obvious that a single historical fact and a glance at any surviving temple will probably be sufficient. Pausanias tells us that in the Heraeon at Olympia the pillars were originally of wood; as these decayed they were replaced by marble columns till, in his day, only one of wood remained. With this hint we can see that at every point the Doric temple is a translation: the fluted columns are tree-trunks bound round at the top to prevent splitting; the roof is of simple tie-beam pattern; the architrave was the main longitudinal beam; on this rested the tie-beams whose ends are represented by the triglyphs, with the metopes between. Even the wooden pins which secured the rafters are represented in stone as the guttæ.

Both the Ionic and the Corinthian orders show traces of their derivation from wood, though less noticeably than the Doric. The use of wood has been demonstrated in the prehistoric architecture of Knossos and Mycenæ: the Lion Gate has been regarded by some authorities as the prototype of Doric; the side-posts and lintel suggest timber, and the sculptured column a kingpost, the lions filling in the gable as ornament.

Another example of translation from wood to brick and stone may be found in the Hindu temples of northern India, where the "sikhara" roofs are derived from a structure of bamboos tied together at the apex and thatched.

The connection between architectural style and the materials available locally may be seen in Europe to-day, more particularly of course in domestic buildings. Brick architecture is found in all extensive alluvial tracts, such as the lowlands of the Rhine delta; Bruges is an almost untouched example of a town built of the only material available locally; the "crowstepped" ends of the roof gables are specially characteristic of brickwork and are a conspicuous feature in almost any view of Bruges. The same style is found throughout the alluvial region, whether in Belgium, Holland, or Denmark. A fine example of a brick tower with the batter and the simple ornament of bands of projecting bricks like that of the Mesopotamian ruins may be seen in the thirteenth-century church of Lisseweghe. Many well-timbered regions in Europe are still characterized by wooden houses; a delightful street of such houses may be found at Liseux, in the forests of Normandy.

For important buildings, such as cathedrals, stone has often been brought from a considerable distance, and the influence of local resources is seldom of importance. We may, however, contrast the abbey of Mont S. Michel, built of local granite and other igneous rocks, with contemporary work in Gothic cathedrals built of easily carved limestone.

Even the flamboyant choir seems restrained as compared with St. Maclou at Rouen.

In England the architectural style of a district is often controlled to a large extent by the material available locally, that is by the geology. The dominant formation of the Thames valley below the chalk gap is the London Clay, which produces a soil in which oaks flourish. In the absence of good stone the builder turned to brick and timber, and the architect evolved the glorious Tudor mansions of red brick or the humbler half-timbered crofters' cottages of Windsor Forest. In all the clay areas, such as the Weald or the north Shropshire plain, the half-timbered style flourished, the "black and white" of Shrewsbury and its neighbourhood being especially famous. In a chalk country almost the only stone available is flint; flintwork is familiar in many an ancient church, such as the fine perpendicular example of St. Giles, South Mimms. It has been used in London at the Tower and elsewhere. The few hard bands in the chalk itself have been used since Roman times. The writer was once much puzzled, when making a geological survey in Berkshire, by finding fragments of "Chalk Rock" at a spot he knew to be at a much higher horizon in the Upper Chalk. Further search revealed fragments of Roman pottery, the site being that of a villa of late Roman date.

With such regions one may contrast any in which stone is abundant. In the Lower Jurassic beds of the Cotswolds fissile or flaggy limestones are common, and the houses with their grey stone roofs as well as walls seem to grow into the landscape. The weight of these stone roofs is much greater than that of tile or slate, and the consequent sagging between the rafters adds a charm to the outline.

Another good example of a local style is afforded by the ancient halls and cottages of the Halifax neighbourhood, built of the sandstone and grits of the Millstone Grit formation, the flaggy members of which yield roofing stone. The general design and the slight ornament are both eminently suitable to the material; a prominent characteristic—the great width of the mullioned windows—is indirectly dependent on the geology. The sandstone uplands are not of much agricultural value, but afford good pasture for sheep; every householder wove his own wool, and the windows were wide to give ample light for the work.

Ruskin elaborated the necessity for truth in architecture. Not all his opinions are universally accepted to-day, but it is certain that no architecture can deserve the name in which the design is not to some extent dependent on the material employed. It is, further, desirable that this material should be as far as possible of local origin. At the present time concrete is increasingly used, and since most of the Portland cement is made in North Kent and mixed with Thames river-gravel, we may perhaps claim that concrete is a material local to London, but a specific concrete style of architecture has hardly yet been evolved,

most of the work being in imitation of stone. A possible exception may be seen in St. Peter's Church, Acton Green, which is built mainly of brick with concrete pillars, and is a thoroughly honest and truthful bit of architecture. The plain " monolithic " columns of grey concrete, with simple capitals, are thoroughly suitable to the material. The painted echinus and square abacus fits the general design far better than would a carved capital of real or imitation stone, and the plain projecting buttresses beneath the roof ribs and the ornament of the cornice are of genuine brick character.

Sculpture.

In sculpture, again, the dependence of the art on the material available is well exemplified by the difference between that of Egypt and that of Greece. In the former the stones of sufficiently constant grain and massive formation are mostly hard igneous rocks such as granite and basalt, in the latter the magnificent marble of Pentelicon and other localities. The difference of style resulting from the respective use of these stones is obvious, though not easy to describe tersely. A few contrasted examples will serve the purpose. Perhaps animal statues are even more striking in this respect than those of the human form. Take, for instance, the granite lion of Tutankhamen in the British Museum and the dog attributed to Lysippus at Florence. The lion is dignified and impressive, and as fine a work of art as the dog ; in the one the couchant attitude allows the limbs to be shown in contact with the body and the base, in the other the sitting position necessitates the fore limbs being completely separated from the trunk and from each other. The lion's mouth is shut, avoiding undercutting and detail ; the dog has his mouth open, showing the teeth and tongue. From the physical character of the stone it would be impossible to copy Lysippus's dog in granite ; a marble copy of the lion would lose much of its dignity and would probably look unfinished. The contrast is similar in human (or divine) statues. The Hermes of Praxiteles is almost the only undoubted original Greek statue that can be identified with certainty. The nude form with legs separated, the delicate moulding of the trunk and the detail of the hair, the position of the right arm, which probably held out a bunch of grapes, and the attitude of the child could only be rendered in marble. Contrast any Egyptian statue such as the black granite figure of the Goddess Sekhet in the British Museum—the clothing avoids the separation of the lower limbs, the sitting attitude affords a wide base and lends the necessary stability, the arms are in contact with the trunk, and the fore-arms and hands rest on the knees. It might perhaps be suggested that these differences are not dependent on the material used but on the stage of evolution reached by the art of sculpture, and that the typical Egyptian statues resemble archaic Greek examples dating from before Dædalus, who " made statues to walk " by separating

the legs. But the examples of Egyptian work mentioned, both belonging to the eighteenth dynasty, cannot be regarded as in any sense primitive. The art of sculpture had similar beginnings in the two countries, as elsewhere, but developed along different lines resulting, it may fairly be claimed, from the nature of the material available. Bronze work is in a different position, for in Greece the bronze statues bear a close resemblance to those in marble, whereas Egyptian bronzes are in the main statuettes and clearly copied from those in wood, as may be seen at once from the collections of both in the British Museum. A few only of the larger bronzes resemble the more familiar granite figures.

Second only to Pentelicon is the marble of Carrara and other localities in the Apuan Alps, a metamorphosed Jurassic limestone of slightly coarser grain than the Greek stone. It was used at least fifty years before the Christian era, and with its aid Augustus converted Rome from a city of common stone to one of marble. Most Roman sculpture is in Carrara marble ; the great Italian schools worked in it, Michael Angelo and Canova both visiting the quarries to choose their own blocks. At the present day the district is dotted with studios where sculptors carve the stone on the spot.

An eminent modern sculptor who works in granite, diorite, basalt, and other hard igneous rocks, is a Spaniard, Mateo Hernandez. His home was the wild and rugged granite uplands of the Sierra de Gredos. If the granite has entered into his soul, it is equally true to say that he has completely mastered the nature of the rock, for his splendid animal figures are all chiselled direct from the block without a model.

In England we have practically no true marble and very little stone suitable for fine sculpture. This fact is certainly one reason why, with a single exception, there is no English school of sculpture of any importance. The figures which adorn our Gothic cathedrals are more architectural ornament than sculpture *per se*, and even so it is to France rather than to England that we look for the true home of this class of work. The exceptional richness, in this respect, of the west front of Wells may be due in part to the use of Doulting stone, quarried in the Inferior Oolite a few miles away, which is soft and easy to work when fresh, but hardens on exposure. It may be remarked that in a recent lecture Dr. James of Eton described the fifteenth-century frescoes in the school chapel as an imitation of sculpture, a reflection perhaps of the poverty of suitable stone in England and its complete absence in the Thames valley.

The public statues in London are notorious, and the exceptions prove the rule ! The equestrian statue of King Charles the Martyr at Charing Cross is the work of a Frenchman. The figure of James II. now behind the Admiralty is well executed. The sculptor was of Dutch birth, though he lived so long in England that we may well claim him as an Englishman, but his name is familiar as an artist in a material for which

England has always been famous—it is Grinling Gibbons. The only English sculpture to attain a European reputation was the alabaster work of the fourteenth and fifteenth centuries. The stone is found in abundance in the Trias of Chellaston in Derbyshire, where it is still worked, and it is probably the finest in the world. The centres where it was wrought were London, Nottingham, and York. Magnificent altar pieces and sepulchral figures were sent all over Europe. One particularly fine example has been brought back to England from Spain. One of the best effigies in alabaster is that of Prince John of Eltham, in Westminster Abbey (d. 1334). A beautiful specimen of modern alabaster carving, in part gilt and coloured, may be seen at the Lady Altar in All Saints Church, Margaret Street.

Mention may also be made of Purbeck " Marble," a freshwater limestone of Upper Jurassic age full of the fossil shell *Paludina* and others ; owing to the proximity of the mines and quarries to the sea it was widely distributed, being used as far north as Durham in 1160. It was employed mainly for slender shafts and other architectural ornaments, but sepulchral effigies were also made. Among the best known examples are the tomb of King John at Worcester, and those in the Temple Church ; an early incised slab at Wells shows the full-length figure of Bishop William Bylton the Second, who died in 1274.

Ceramics and Glass Ware.

The material necessary for pottery-making—clay—is found abundantly, and consequently the potter's art has been practised almost universally from China to Peru, and from Neolithic times to the present. Porcelain, essentially a translucent pottery, is in a very different case. True porcelain consists of china-clay and china-stone, minerals which generally occur together, but are by no means common. They were first employed in China, where magnificent supplies are found, about the sixth century A.D., and from the Chinese are derived all other porcelain industries. But much of the so-called porcelain of Europe is not made exclusively of china-clay and china-stone, but largely of other materials, amongst which the most important are bone-ash and a glassy frit. These false porcelains have all the important characters of the true ware, but are considerably softer and are often referred to as soft paste as opposed to the hard paste of true porcelain. The use of glass as one ingredient serves to connect ceramics with the art of making glass vessels similar to those of the potter, denoted in French by the word " verrerie." The materials of glass are almost as common as the clays of the potter : silica in a more or less pure state is obtainable as vein-quartz or as sand ; lime forms the bulk of many sedimentary rocks ; soda or potash can be obtained from marine or terrestrial plants respectively. Consequently glass ware is far more widely distributed in space and time than porcelain, and in the Mediterranean civilizations held for two thousand years or

more the place taken by that material as a more delicate and beautiful material serving the same purposes as pottery. It is doubtful whether glass-making originated in the Nile delta or on the Syrian coast. Both were important centres. In Egypt soda was readily obtainable from the natron lakes, and the copper ores of Sinai supplied colouring matter for the famous blue glass and faience. Along the Syrian coast a soda-lime glass was made, the art attaining its highest development round about 100 B.C. to 100 A.D., but glass hardly distinguishable from that of Roman times except by the state of preservation is being made near Hebron to-day and can be bought in London.

In the Greek islands glass vessels of the sixth century B.C. have been found, but they are of Egyptian type ; in Greece itself there is no glass, its place being taken by the glorious figured pottery made from the clays of Cape Kolias coloured with ochre. Rome, on the other hand, had no more delicate pottery than the so-called Samian ware, and glass-making flourished exceedingly and reached great artistic heights. It is frequently the case that glass and fine pottery are more or less complementary. The glass of Venice answers to the majolica of Umbria and Tuscany ; the Murano works owed their original fame to the excellence of their colourless glass, due to the selection of the purest silica, the vein-quartz pebbles brought down by the Po and the Ticino from the mountains. The alkali was soda mostly imported from Syria. In China, the home of porcelain, glass occupied a very inferior position, being chiefly valued because vessels can be made in superposed layers of different colours and cut in cameo, an art practised in Imperial Roman times. In painted decorations, on the other hand, pottery and porcelain have the advantage over glass, though an ingenious method of decorating the latter with figures was in vogue in Rome from the third to the sixth centuries ; gold leaf was applied, usually to the under surface of glass bowls, etc., cut away and engraved to form the design, and then sealed in with another layer of glass. The typical examples are the Catacomb glasses fully described by O. M. Dalton and others. The method was revived at Murano in the sixteenth century.

Perhaps the finest decorative glass is to be found in the enamelled Saracenic lamps of the fourteenth century. The body of this glass contains about 4 per cent. magnesia, which tends to raise the melting point and so enables the enamel colours to be fired. Its presence is due to the use of the magnesian limestone in the Cretaceous rocks of Syria. The enamels were mostly easily fusible lead glass.

Leaving the Mediterranean we pass to China, whose porcelain has profoundly influenced later European ceramics. Her supplies of china-clay (kaolin) are unrivalled, but for one class of ware she has always been largely dependent on imported material. " Blue and White " has always been popular with collectors of Oriental " china." The blue is, of course, a cobalt colour, and the Chinese cobalt-ores are very poor,

whereas those of Persia and Baluchistan are excellent. Burton has shown that the cobalt was imported by the Chinese throughout the fifteenth century, the period of the finest blue and white porcelain, under the name of " Mohammedan blue." Up to the middle of the sixteenth century a little was still obtained at the price of twice its weight in gold ; then the supply ceased, and the quality of the blue decoration deteriorated.

The trade between China and Persia gave rise in the latter to an attempt to imitate porcelain, but there was no local supply of china-clay. A glassy artificial porcelain was therefore made, familiar to collectors as " Gombroon ware," from the name of the port on the Persian Gulf whence it was brought to England. Again a compensation for the lack of porcelain was found in the development of artistic glass-ware, although Persian decorative pottery is almost unrivalled. Glass-making was revived by a Venetian about the middle of the seventeenth century, though the art had been known in Persia centuries before. Much of the Persian glass dating from round about the beginning of the eighteenth century is most attractive, though not very well known. The collection in the Victoria and Albert Museum is said to be the finest in Europe. Curiously enough the blue glass coloured with cobalt is the least pleasing, being of dull and heavy form, often gilt, and almost modern in appearance.

In Europe Oriental porcelain became well known in the sixteenth century. The nearest approach to it then made was a pottery with an opaque white glaze made from tin. The mines of Spain supplied the tin and the Moors the technical knowledge. From Spain the art spread to Italy, majolica being a tin-glazed pottery decorated with metallic colours, mistakenly named from the island at which the boats from Spain touched *en route*. The Low Countries became the chief centre for the manufacture, and the ware has long been known as Delft. All the white-glazed pottery, however, lacked the translucency of porcelain. The first attempt to imitate the latter to meet with any success was at Florence in the second half of the sixteenth century. This famous Medici porcelain was made from an impure china-clay, the Terra di Vicenza, fine white sand, and a large amount of glass. It is not unlike the gombroon ware. A similar glassy porcelain was made about the same time in Russia. The first true porcelain was made by Böttger about 1712 from the china-clay of Aue, in the Erzgebirge, thus starting the Meissen (Dresden) works. In 1768 the first French hard-paste was made at Niderville from German materials, but soon afterwards the fine china-clays of St. Yrieix, near Limoges, were used. This clay was also adopted for use at Sèvres, where hard-paste was first made in 1769, a dozen years after the manufacture of soft paste (*pâte tendre*) was transferred to that locality from the Château de Vincennes.

The comparative scarcity of china-clay led to the adoption in many countries of another imitation of porcelain, a semi-opaque glass of milky-white colour produced, as the white enamel on pottery, by tin

oxide. The best example is the Spanish glass made in Cataluña in the early eighteenth century. This is decorated with flowers, figures, and conventional patterns in enamel colours, and is utterly unlike the ordinary Spanish glass of that and earlier periods, but both the forms and the decoration can frequently be matched exactly with pieces of oriental porcelain. Similar glass was made in France and in Germany. In the British Museum there is even a teapot of milky glass made in Germany, while a French glass-maker is mentioned as imitating agates, gems, and Chinese porcelain at Orleans in 1691. In Italy the Lattimo glass was made at Murano as early as the beginning of the sixteenth century. It was revived in the early eighteenth century, and later we even find it painted in monochrome in imitation of transfer-printed Worcester porcelain.

Turning to England, we may retrace our steps and notice a few points where the occurrence of the requisite minerals has, on a smaller scale, influenced ceramic art. In almost every county clay fit for making pottery of some kind may be found, the geological age of the stratum varying from the Carboniferous to the recent alluvial clays used by the Romans in Upchurch marshes and elsewhere. Even such an unpromising clay as the Gault was used at Wrotham in the seventeenth century for making the well-known slip-decorated ware. More recently pottery manufacture of all kinds has been localized mainly near the sources of fuel and refractories, much of the clay for making the body of the ware being brought from a distance, such as the Dorset clays, though the clays in the Coal Measures are largely used. Delft ware was first made at Lambeth, partly perhaps on account of the proximity of the chief market and also because the art was introduced by Dutchmen who came to London. Bristol, however, soon became the chief centre. Both fuel and the materials for the body were available locally, but a further advantage may be found in the fact that Bristol was one of the chief ports for the tin trade of Cornwall. An interesting bowl of Bristol delft, formerly in the Geological Museum, but now at South Kensington, has the following inscription :

> " John Udy of Luxillion
> His tin was so fine
> It glidered this punch bowl
> And made it to shine.
> Pray fill it with punch ;
> Let the tinners sit round.
> They never will budge
> Till the bottom they sound."

The peculiar " blue dash " chargers have now been traced to Bristol.

A rough glass was made in very many parts of the country, mainly from sand and potash derived from the ashes of bracken and other plants. The metal is of a greenish colour due to iron in the sands, and bubbly

and coarse in texture. It is known in France as *verre de fougère* (bracken). In the sixteenth century the manufacture was largely concentrated in the Weald, where it had existed for a long period. At Chiddingfold better class ware was made from the Hastings Sand, which is comparatively free from iron. The oak forests of the Weald Clay supplied the fuel and the ashes of oak, beech, and bracken the potash. When the use of wood for fuel was restricted, the workers moved first to the Forest of Dean and then to Stourbridge, whose refractory clays found in the Coal Measures are unrivalled for making glass-pots. The special glory of English glass is the brilliant potash-lead metal known as "flint glass," admirably adapted for cutting and faceting. The term first implied a metal for which the silica was derived from flints, but was transferred to lead glass which was first made in quantity during the latter part of the seventeenth century. All the great glass-making districts, Stourbridge, Birmingham, Sunderland, Bristol, and others were within easy reach of lead-mines. At Bristol a considerable amount of milky glass containing tin from Cornwall was made, but it seems probable that it was a copy of the Spanish ware that found its way to the port rather than a direct imitation of porcelain. Some of the chalky white glass with enamel decoration for which Bristol is specially famous suggests Battersea enamel rather than porcelain. An interesting example of a glass works founded where every necessary material was available has lately been described by Mr. J. Kenworthy. The Bolsterstone works, near Sheffield, were in existence from about 1650 to 1750, and made brown, green, and black bottle and flint glass, turning out characteristic English wine-glasses with air-twist and other stems, and also coloured fancy work like that of Nailsea, near Bristol. A fine siliceous sandstone containing 89 to 92 per cent. silica was quarried on Townend Common, fire-clays and gannister for the pots were mined on the spot, and lead in the Ewden valley, while the surviving names "Glasshouse Wood" and "Bracken Moor" indicate the sources of potash and fuel. Coal was also available.

Every collector of old English porcelain knows that there were only two factories that used hard paste, Plymouth and Bristol. The china-clay and china-stone occur together in Cornwall. Cookworthy discovered them at Breage and St. Stephens between 1750 and 1755, and started his famous works at the neighbouring port of Plymouth. The use of the "two-four" mark, the sign for tin, may be taken as a compliment to Cornwall. Bristol, the port for north Cornwall, was the site of Champion's works which afterwards took over Cookworthy's rights. They were removed to New Hall, near Shelton, about 1781, and a little hard paste was made from the old recipe, but later a "hybrid" paste containing 35 to 40 per cent. bone-ash was introduced (see Eccles, H. and B. Rackham, 'Analysed Specimens of English Porcelain'). Other English porcelains have been but little influenced by local resources.

The soapstone of Mullion was an important constituent of the ware made at Lowdin's factory at Bristol, which was very shortly united with the Worcester works. The famous Worcester paste owes its peculiarity to the use of the soapstone, as much as 40 per cent. being found in a number of analyses by Mr. Eccles. An occurrence of large quantities of felspar suitable for glazing near Lough Erne in north-west Ireland led to the foundation of the Belleek China works in 1857, but the peculiar lustre is due to the use of bismuth salts.

Many minor arts and crafts afford curious instances of their connection with natural resources; for instance, it is clear that the original home of Anglo-Saxon jewellery must be sought in a country where garnets are abundant; it has now been demonstrated that this home lay in Southern Russia; the Sarmatian and Gothic jewels of the third and fourth centuries A.D. found at Kerch and Oldia in the Crimea are barely distinguishable from those familiar to us from Kent.

While it is obvious that the above notes might be amplified almost indefinitely, it is hoped that sufficient has been said to show that the influence of mineral resources on the arts is a subject worthy of attention.

Before the paper the CHAIRMAN (Sir FRANCIS YOUNGHUSBAND) said: The subject of the lecture this evening is, "Natural Resources in Relation to the Arts," and I have pleasure in introducing you to Mr. Bromehead, who gave us a remarkably interesting address a few years ago upon the Geography of London. We Londoners know uncommonly little about the geography of our own city, and I remember what an enlightening address it was that Mr. Bromehead gave us on that occasion. We are, therefore, looking forward this evening to hearing him again.

Mr. Bromehead then read the paper printed above.

The CHAIRMAN: The lecture has been rather technical, and I am afraid there are very few observations of any value or interest that I can make on it. The lecturer made reference at the start to the influence of the Yorkshire moorlands and the character of the rocks upon the authoress of 'Wuthering Heights.' As you all know, Emily Brontë spent practically the whole of her life in wandering about those moorlands, and directly she went away from them she seemed to fade away altogether and to pine to be back again on the moors. As a consequence the effect of the moorlands upon that most sensitive nature was extreme, and we have the result in that wonderful book 'Wuthering Heights.' Is there any similar example in literature of the effect of limestone upon some one as sensitive as Emily Brontë? Limestone breaks up into perpendicular cliffs. One sees in the Alps and in the Himalayas cliffs going up to hundreds and even thousands of feet in height, almost perpendicular, and one wonders whether there is any instance in literature of some one like Emily Brontë going out day after day and year after year and constantly facing those vast perpendicular cliffs. If so one would like to know the effect of such an experience.

The part of the lecture which really interested me most was, I think, that which dealt with the change which came over architecture from the use of a new material superimposed upon a different material which was formerly in use. The lecturer instanced the case of Egypt, where the builders used bricks

first of all, and then eventually came to use stone, but in erecting those stone buildings they extensively copied what they had already been making in brick. My mind at once went back to Tibet. In Tibet there is very much the same type of architecture as is found in Egypt. If you look at any photograph of Tibetan architecture you will see that it is really very much the same as the Egyptian. There is that very prominent "batter," the base of the buildings being very much broader than the top part. This is seen in all buildings in Tibet the same as it is in Egypt; it is not merely in the most prominent buildings: it is in all. This is very strikingly illustrated in the Grand Lama's palace at Lhasa, the Potala, which is on a very prominent hill that rises abruptly from the valley. But in all the monasteries and in every single village in Tibet there is exactly the same characteristic as one sees in Egypt. Yet in Tibet they never have had bricks. I do not suppose there is any clay there at all. They must always have built in stone, and they are remarkably fine stone-workers. Although there are the same architectural features as are found in Egypt, it would seem that in Tibet they are not copies of brick buildings, but must have come naturally of themselves. Therefore I was wondering whether those Egyptian buildings were copies of brick buildings or whether they had sprung up spontaneously, as it were, in stone.

However, that is only a very unimportant observation. I know that you would like me to thank the lecturer for his very suggestive address. I think we ought specially to thank him for being here at all. I believe that prior to his dining with us this evening the doctor was in his house peremptorily ordering him not to get out of bed as he was very ill with influenza. I hope that the doctor does not see in the paper to-morrow morning that Mr. Bromehead has been lecturing to us at this hall this evening.

THE CHOICE OF A GRID FOR BRITISH MAPS

Read at the Afternoon Meeting of the Society, 17 March 1924.

I. THE NATIONAL GRID

Colonel H. S. L. Winterbotham, C.M.G., D.S.O.

IN the January number of *Annales de Géographie*, Mr. de Martonne gives certain details of French plans for the new 1/50,000 map. It would appear, from this description, that the projection which characterized the earlier sheets of the 50,000—the polyhedric—is to be abandoned, and to be replaced by an orthomorphic projection. The sheets are to be rectangular and are to show a "national grid."

The United States of America have achieved considerable progress in the spread of their one-inch maps, which are on a polyconic projection, The sheet lines of this series, being defined by meridians and parallels. do not lend themselves to the introduction of a "national grid." Nevertheless, tables have been prepared to facilitate the overprinting of a grid for military, if not for civil, purposes.

Recent military and scientific German periodicals give details of a change of German national mapping policy. A commission or board

under their Home Office deals with mapping questions and represents the opinions not only of the Reich, but of the individual states which compose it, and of the fighting services. This board has recently decided to introduce a " national grid " upon all German maps.

The grid has, in fact, become an important feature of military mapping, and threatens to develop into a national affair. We are, then, to ask ourselves the following questions :

(1) What is a grid ?

(2) Is it of importance to the nation at large ?

(3) If so, what form should it take ?

It is my duty to give you the answer to the first of those three questions.

Before the war, it was customary to add in the margins of maps some system of reference by whose aid to track down a town, a river, or a mountain into a particular square or enclosed figure, and thereby to render unnecessary a vain search over the rest of the map. The usual system of reference was one dividing two opposite margins into similarly lettered parts, the other two into numbered parts.

This was not, however, the only system of reference. There was another which depended upon polar coordinates. Some point, generally the centre of the east margin, is made the pivot for a graduated strip of linen, which can be pulled out straight and revolved so as to read against tangent scales on the other margins. A particular point could then be defined with reference to the tangent marginal scales and to the distance along the rotating arm.

These systems of reference undoubtedly save a great deal of hunting over the map. It must be noted that their value is limited to the sheet on which they appear, that is, a square defined as A.2. gives one no information unless one knows which map it is to which reference is made. Moreover, as experience with town maps shows us, the search even within the square may take time.

When the Expeditionary Force left these shores it was equipped with maps some, at any rate, of which had these marginal letters and numbers. Presently, when the British Army, advancing after its preliminary retreat, came to an enforced stop firstly upon the Aisne and secondly in Flanders, the halts were sufficiently prolonged to make it necessary to issue larger-scaled maps. These maps, on the scale of 1/20,000, called for some more handy and accurate system of reference, to define not only a square but the exact spot in that square at which to look for a particular feature. A committee was appointed to evolve a suitable system of reference, and the task in front of it was one of peculiar difficulty. It had so happened that the Belgian maps were being printed in England. As we always felt that we were on the point of driving the Germans before us into Belgium, we desired to use Belgian sheet lines, which differ from French sheet lines, for maps of French territory lying to the west. But Belgian and French sheet lines are functions of the metre, and British

troops, at that time at any rate, thought mainly in yards. A system of reference, then, was required which should give squares of a definite number of yards, and which would yet fit as nearly as possible upon a map whose dimensions were governed by the metrical system. It was possible to divide a 1/40,000 sheet into squares of 1000 yards so nearly that by a little fudge in the printing the east and west lines of these reference squares were made to coincide with the sheet lines. North and south it was not so possible, and the reference squares projected beyond the sheet lines. The whole area of the 40,000 was then divided, and not quite equally, into twenty-four parts, each of which was given a letter. These parts were then subdivided into so many squares of 1000 yards side. It will be seen from the illustration that twelve of these letters had thirty-six such squares, while twelve had only thirty. On the east and west margins were a row, or line, of half-squares. Each 1000-yard square was subsequently divided into four quarters, which were labelled a, b, c, and d, and each of these little and ultimate squares was divided decimally by eye or scale. A full reference, then, ran in this way:

Sheet 51—M.35.d.34.

It will be observed that it was still necessary to quote the sheet.

Side by side with our system grew the French. Now in French eex and ygrec have a more friendly sound than x and y have to us. The French went, therefore, boldly and logically for a rectangular coordinate system covering the whole area (or a very large part of the area) instead of keeping to a single-sheet system. Their "grid" was a vast grid of kilometre squares—and the sides of them were numbered consecutively, eastwards and northwards, from an origin so remote from the front as to be secure from intrusion. Thus signs were always positive. Inside the squares decimal division was done by eye or scale to the nearest 100 metres, or, on large-scale maps, to the nearest 10 metres.

Here we get a substantial step further than in the British squaring. We have, in fact, progressed from "squaring" to "gridding." The horizon is broadened from a sheet to a country. Quite independently of the map, indeed, the relative positions of objects can be defined on the grid. Let us take an example. A gunner finds that the coordinates of his gun are x and y, and this he does not from the map but from a small survey. A sound ranger reports a hostile gun at x′ and y′. Two minutes with a log-book and the bearing and distance of the target thus disclosed are computed. The problem is very different if it is possible only to use references for identification on (say) a couple of maps. In the one case a result accurate to, say, 20 feet may be expected; in the other, to 50 yards.

We see, then, that a grid is a system of reference which can be applied to a very wide area (say Great Britain) and which enables the location of any place, on the ground, if you will, or on any map of whatever

scale. It enables one to compute the distance between any two points whose coordinates are known—between John O'Groat's and Land's End, if it be desired—and, equally, to compute the bearing or azimuth. In this guise the grid becomes an old friend. It is nothing but a rectangular coordinate system. We adopted it for the British forces in Italy, and we should have adopted it in France in 1918 had the war not, happily, become a mobile one.

But there are practical difficulties about this grid. It must be composed of squares, and, as the earth is round, continuous and perfect squares cannot be fitted on it. There is a story of certain surveyors (not Royal Engineers) in an Eastern portion of the Empire, who started to divide a wide area of cultivable land into squares by running straight lines out at right angles from a meridian. The unfortunate recipients of lots far from the meridian raised a justifiably loud outcry.

The squares of the grid must remain square on the projection chosen for the grid, but are bound to depart in time from the perfect square on the ground. Nevertheless, the defining lines of the squares can be traced on the ground, for they are as definite mathematical lines as meridians or parallels.

But if you choose one projection, say " A," for your grid, it does not mean that you cannot plot that grid on a different projection, say " B." You have, as it were, traced on the ground those lines which make perfect squares when mapped in projection " A."

If you map on projection B you can survey these grid lines (even though they are imaginary) with the rest of the detail. They may not be perfect squares on projection B, but will, probably, not be sensibly different. It has therefore happened on several occasions—and will doubtless happen again—that survey operations and references are given in terms of projection A, whilst the grid is shown graphically on projection B.

A full grid reference is given by complete easterly and then northerly coordinates, thus :

152034 West—206793 North (to the nearest metre)

But generally at most scales a reference to the nearest 100 yards or so is enough. If our units are yards or metres we can say, then :

1520 2068 (to the nearest hectometre)

(N.B.—We may omit " west " and " north " if they always follow the same sequence.)

Now supposing that it is only the countryside within 10,000 yards or 10 kilometres that we are considering, we can leave out the earlier figures and write :

20 68

There are two matters which deserve particular attention in relation to this grid :

(*a*) The size of the squares. As the referencing is to be the same on any scale, a square has to be chosen which is of about the ideal size on the most important scale, but which will be neither too large nor too small on other scales. Shall it be 1000 yards, a kilometre, 10,000 feet, etc.? The two necessities are that it shall be decimal, and shall be in terms of some unit which can be used with the ordinary surveying instruments. The unit must, in fact, be the yard, the foot, or the metre.

(*b*) What is the best method of abbreviating coordinates to fit different circumstances?

Our present practice is to give every 10-kilometre-square a letter and to add decimal references within the square, thus:

A 4562 (to the nearest 100 metres)

As there are twenty-five letters (or five squares) the alphabet covers a square of 50 kilometres. At every 50 kilometres therefore reference is repeated. If we added two more figures in front, however, instead of letters, we should get say 345762, a reference repeated each 100 kilometres.

Enough has been said, it would seem, to explain what a grid is and how references are made in it.

In England we have for military purposes a grid on the Cassini Soldner projection, with its origin at Dunnose, whereas the small-scale Ordnance Survey maps are on a similar projection with origin at Delamere. It has been necessary to introduce the second (Dunnose) grid because we work at present on a projection which is not orthomorphic. The position is not, however, satisfactory. We soldiers must have a grid. Moreover it must rest on a simple system of coordinates in order to facilitate local surveys, and must be sufficiently precise (in an angular sense) to give instrumental observation its full value. Such a grid is so great a convenience that we shall not be content without. Military operations, like all other large engineering undertakings, require the smooth working of many interdependent parts. In order that every one may be at the correct place, that unforeseen contingencies may be intelligibly reported, and that new combinations may be formed, it must be possible for every unit of the machine to understand quickly and accurately the place of which his commander speaks, writes, telegraphs, or telephones. He may have to go there, to send there for his food, to meet some other person there, to deliver a message there, etc. At present we have a separate military edition, and must make special computations to adapt the trigonometrical data. It is however plain that we can, by using an orthomorphic projection, readopt the Delamere origin of the Ordnance Survey small-scale maps.

Now Ordnance Survey maps already bear a network, not wholly consistent, of two-inch squares. In place of those squares is it not possible to substitute a grid, suitable at once for civil and military purposes? Mr. Hinks will speak on the point of view of the civilian,

but I cannot refrain from emphasizing the real advantages which the man in the street would gain.

For example, A loses his way, he reaches a signpost and sees on it 372435. His map then shows him where he is.

B skids in his car, turns over into a ditch, rises in wrath, finds a telephone office, and asks for breakdown gang at 404983.

C calls up D and tells him to be, with horses for both, at 592176 at 14.00 hours.

There are times, and many, when reference is not required; for example, if one were to say, "Are you going to the Society's Meeting on Grids?" both time and place are obvious; but there are countless times when references would save much time, and it is noteworthy that our existing street names and numbers are only an unscientific prototype of this referencing.

Had Sir Walter Scott written in times in which a national grid was employed, how much our libraries would have been spared!

II. THE GRID FOR BRITISH MAPS

Colonel E. M. Jack, C.M.G., D.S.O., Director-General of the Ordnance Survey

1. I speak as the official responsible for producing the national maps, who has to combine, as far as possible, the needs of both military and civil users.

We have seen from Colonel Winterbotham's explanation that for military purposes it is essential to have a grid on our maps, with a single system of coordinates to define the positions of all points. For civil purposes it is not essential, but such a system would be of great value, particularly in large towns and crowded areas.

For military purposes we have not to consider æsthetic questions; we can adopt what is best for the purpose in view, even if it makes the map unattractive. For civil purposes these questions however become important. If a map is made unattractive it will not sell well.

It is, however, uneconomical and for many reasons inconvenient to have separate military and civil editions. It is therefore of importance to devise if possible a form of grid which will satisfy military requirements, and at the same time will not affect the public demand for the map.

2. The Ordnance Survey small-scale maps which are in common use, namely the 1-inch, $\frac{1}{2}$-inch, and $\frac{1}{4}$-inch maps, are already provided with a system of squares, in all cases of 2-inch side. It may be asked why these will not serve military requirements. The first reason is that these squares do not form a grid. A grid is a system of squares which extends over the whole area or country, independently of the

sheets of the map. The squares on the Ordnance Survey maps are dependent on the sheet, and have no direct connection with the squares on the adjoining sheet. No common system of coordinates could therefore be based on the Ordnance Survey squares.

The second reason is that it is desirable that the dimensions of the squares in a grid should be on a decimal basis, that is, that they should be measured in multiples, or preferably powers, of ten units. This is not essential, but it is certainly highly desirable, for reasons of simplicity and convenience. When we define the position of a point within a square, we use co-ordinates measured in tenths, hundredths, etc., of a side. If our square has a side of 1000 yards these successive subdivisions are 100 yards, 10 yards, 1 yard, etc., in length. If we were to subdivide the existing square side on the 1-inch map in the same way, the divisions would be 352 yards, 35·2, 3·52, etc. This would have certain inconveniences.

It would seem, therefore, that if military requirements are to be met adequately some change will be required in the squaring on Ordnance Survey maps.

3. In considering the effect of any change in a map in respect of which the convenience of the public and the selling value are matters of importance, we have to take into account the following points :

(1) The effect on the appearance of the map.

(2) The effect on its utility.

(3) Consequential effects, such as alteration in sheet lines.

(4) Financial effect.

It will be useful to consider under these four heads a proposal that has been made in the course of discussions on this subject, to adopt a grid with squares of 10,000 feet side on the 1-inch map, in place of the 2-inch or 2-mile squares. The reason for considering in detail this particular proposal is that it is the only definite one hitherto put forward for solving the problem. Remarks of a similar nature, and in some cases the same remarks, would however be applicable in the case of any change proposed.

(1) *Appearance.*—It is obvious, that so far as size goes, the proposed squares would not affect the appearance of the map at all. They are only slightly smaller than the 2-inch squares. The fact that they do not fit the sheet would however be some disadvantage. I will refer to this point again shortly.

(2) *Utility.*—Before discussing the effect of such squares on the utility of the map, I must digress for a moment.

The present squares were put on the map for the purpose of assisting reference and identification. For this purpose it is evident that the size of the square, within limits, does not matter. But it is believed that they are also largely used as a scale of miles, conveniently distributed over the map.

For the purposes of reference the change to 10,000 feet would therefore be immaterial; but for scale purposes the change would be bad. 10,000 feet conveys nothing to the mind, whereas 2 miles conveys a very definite idea. The very fact that 10,000 feet is not very different from 2 miles (10,560 feet) might be misleading and therefore a disadvantage.

(3) *Change of Sheet Lines.*—As our existing sheets are measured in inches, squares of 10,000 feet side would not fit the sheet exactly. The squares would fall irregularly and differently on every sheet. It is not essential that the squares of a grid should fit the sheet, but it is better that they should do so, especially on a map which is for sale, as the appearance of the map is thereby improved. If the size of the squares on the 1-inch maps were changed, it would almost certainly be necessary eventually to adopt a new size of sheet to conform; and this change would have to extend to the $\frac{1}{2}$-inch and $\frac{1}{4}$-inch series. Such a change is not impossible, but it would involve (as similar changes have in the past) expense to the Ordnance Survey and annoyance to the public. It is not a matter to be undertaken lightly.

(4) *Financial.*—The financial effect would depend on the above. A change which adversely affected the appearance or utility of the map would certainly have an effect on sales, which might be serious.

4. As far as the Ordnance Survey is concerned the crux of this matter is contained in the second point discussed above: the question whether an alteration in the dimensions of our squares from miles to some other unit would materially affect the map from the public users' point of view. The mile is our unit for measuring long distances; the yard and the foot are not. Would such a change have an adverse effect? I want an answer to that question very badly, and I shall be grateful for any help I can get towards obtaining that answer. I hope that any one in this room who has views on the subject, and particularly any one who is not a professional geographer, will say something about it. But though answers in this room will be valuable, I can only get the real answer by questioning many thousands of the public.

If I were to do so, I think it probable that I should get three types of answer.

The first would be that he or she did not know there were squares on the map; had never noticed them. It is evident that a slight change would not affect this class of map user.

The second would be that he found the squares very useful for reference or for locating a point. In this case again a change would be immaterial.

The third would be that he found them useful for measuring distances. In this case a change from miles to feet or yards would be resented.

I do not know in what proportion these answers would be received.

5. In the foregoing remarks I have dwelt solely on the Ordnance

Survey point of view ; the difficulties that would be encountered and the considerations that must be weighed before carrying out such a change in the national maps. I may be unduly apprehensive, but changes sometimes have results that it is difficult to foresee, and it is my duty to be cautious.

But I feel that I have not contributed much to the real subject of this discussion, which is the question of what would be the best grid for British maps. I find it somewhat difficult to do so until the mile question is settled. But, assuming that the mile dimension proves not to be so important as I have suggested (and although I have made rather a point of it I think it quite likely that it may not), and that we adopt a grid with squares in another unit, I must confess to a predilection for yards.

Our choice lies among three units, if we omit the Continental metre ; namely, miles, yards, and feet.

I would discard miles, because it would mean dividing the mile decimally, and the mile does not lend itself to that form of subdivision.

Between feet and yards there is, I think, not much to choose ; but as it is not our custom to reckon long horizontal distances in feet, I would give the preference to yards ; and for this choice there are two other good reasons. First, that the yard is the unit used by the Army for expressing ranges ; and second, I think that a grid in yards is more adaptable to certain other scales which we must consider, even though we may agree that the 1-inch is the most important. I would use a 10,000-yard square on the 1-inch scale, but as this is rather too large for convenience I would subdivide it into four squares of 5000-yard side. On the $\frac{1}{2}$-inch and $\frac{1}{4}$-inch the 10,000-yard square could be used conveniently.

I would give references as at present in the 10,000-yard square. As letters and numbers on the face of the map are to some extent objectionable, I would identify these 10,000-yard squares by marginal letters and numbers applied to the whole series of squares over Great Britain. As there are not enough letters in the alphabet for this purpose, I would suggest using double letters, AA, AB, AC, AD, . . ., BB, BC, BD, etc. Thus a square would be referred to as 45 MT.

III. THE GRID IN CIVIL USE

Arthur R. Hinks, C.B.E., F.R.S., Sec. R.G.S.

The conspirators who have staged this discussion have cast me for the part of the man in the street ; but I am allowed to speak for the *intelligent* civilian. What use would the intelligent civilian make of a grid if he had it on his maps of Great Britain ? Colonel Winterbotham has already explained that a uniform grid extending unbroken over

the whole series of sheets of all the maps on different scales is extraordinarily useful—indeed essential—to the modern soldier, who uses it for (1) identification of points on the map, and transfer of a point from one map to another, perhaps of different scale; (2) for calculation of distance between two points; and (3) for calculation of bearing from one point to the other. The intelligent civilian would if he could—or will when he is taught how—use the same properties of the grid (for indeed I do not know that there are any other uses than these three), but he will use them for different ends and in different proportions. For example, I think that the civilian will not want to compute bearings as much as the soldier, though I shall have a remark on bearings for civilians later. On the other hand, the civilian will make a more extended use of grid references than the soldier normally does, and will tend rather, I think, to longer distances. Let us see how these tendencies may be met for the civilian.

Consider first the unit of measurement. Our non-decimal system of measures, our indiscriminate use of miles, chains, yards, feet, and inches in measuring distances, according as we are motorists, land surveyors, athletes, or builders, added to our ingrained expectation that so many inches on the map shall represent so many miles on the ground, make it impossible to please all parties at once; but so long as our maps remain on the inches-to-the-mile system (with the remarkable exception of the 1/2500, which employs for once a "natural" scale precisely where it is of least use), then I am inclined to think that our grid must be in inches, and give distances in miles. The civilian rarely uses yards above 1000, or feet for horizontal distances above a few hundreds except in geodesy, though for vertical distances he uses feet up to the stratosphere at any rate, and to the profoundest depths of ocean. It is true that he rarely decimalizes the mile, though quite accustomed to doing it for the inch; but, on the other hand, he would be equally unused to the decimal subdivision of Colonel Winterbotham's 10,000 feet. A thousand feet horizontal evokes no mental picture in the civilian's mind, nor does 100 feet: for such distances he thinks in yards. And so, if he has to be taught to use a grid, I believe he will find it simplest to measure the map in inches and decimals, for which the necessary tools are always to hand; and when he wants to translate the grid measures into miles, he will just have to learn to think decimally.

But by far the most common use of the grid will be for map reference. He will be given the coordinates of a signpost or lamp-post; of a house in Laxham Gardens or the Finchley Road; of a theatre in Soho; of a cemetery in ill-defined south-west London; a golf course in Surrey; an inn in the New Forest; a quarry in Dartmoor; a repair shop in the Highlands; and will want to locate it on his map, which may be quarter-inch, half-inch, one-inch, 1/20,000, six-inch, or 1/2500. No unit for the grid square can possibly give convenient-sized squares on all these

different scales. A grid of squares less than one inch obliterates the map; and bigger than 4 inches is not very convenient. But we should note that if the grid is in inches or simple multiples of half an inch, the necessary plotting can often be done without special scales or coordinate cards. Thus, for example, an inch grid on the one-inch map, and a $2\frac{1}{2}$-inch (10 miles) grid on the quarter-inch map are convenient. For the half-inch map a 5-inch (10 miles) gives rather too large a square, though the edges or all the lines of the squares may be "ticked" or divided into half-inches without damage to legibility. But it would probably be better to have a $2\frac{1}{2}$-inch (5 miles) grid on the half-inch map, and tick off the inch divisions. An inch scale divided decimally would serve for more accurate plotting with a minimum of mental arithmetic.

It is perhaps worth noting that the existing 2-inch squares on the one-inch-to-the-mile map would serve civilian needs fairly well on this map, if they had been numbered as alternate lines of a mile grid instead of for area references on individual sheets.

Turn now to the origin and numbering of the grid. The Ordnance Survey is committed to the central meridian of Delamere, but would presumably adopt a fictitious zero away in the south-west to avoid negative signs. The capital city lies so far east that it cannot hope for the central meridian. So long as the sheet lines remain as at present it cannot even hope that either of the recognized "centres" of London, Charing Cross or the Cross of Saint Paul's, shall have a good round number as its grid reference. But I would urge that if it ever comes to re-drawing the map of Great Britain, it would be worth while, in the general recomputation that must take place, to shift the central meridian just enough to make a north–south grid line pass accurately through Charing Cross or Saint Paul's, and choose the origin so that the grid reference was something simple like 400,100. The grid for maps of London is so important that it is worth a little trouble to get it neat and appropriate.

At any rate, the full grid reference for Great Britain must involve whole numbers to three figures, besides the decimals, in each coordinate, and the zero should be so far south-westward that all coordinates in any part of Great Britain run into hundreds.

My feeling is that the civilian will use the complete and full map reference more than the soldier—or at any rate the British soldier—has done up to the present. The British military system confines its figures within a ten-unit square. These ten-unit squares are bunched together in 50 (not 100) unit squares, and the ten-unit squares are lettered with the twenty-five letters of the alphabet, omitting I. The letters therefore repeat after fifty units. The method has somewhat the aspect of an improvisation; but it is illogical; and if it works well for military needs, it seems to me quite unsuited for civilian use. No civilian can be expected to remember that the squares surrounding K, for example, are lettered

E, A, F, L, P, O, J, D, as we work round clockwise from the north. The letters in the centre of each 10-unit square ruin the appearance of the map ; and one hopes they will disappear. It is doubtless unnecessary to say that the grid must be an integral part of the projection. British sheets are rectangular, and the convergence of the meridians is so considerable in our northern latitudes that they are likely to remain so. Indeed, the introduction of the grid must almost inevitably kill the otherwise attractive sheet bounded by meridians and parallels. The meridians and parallels will remain more or less oblique to the sheet edges, to puzzle and mislead the uninstructed. But the grid must be square to the sheet-lines, and the sheet-lines must be grid lines. An oblique grid not fitting the sheet-lines would look too much like the early stages in another war. If the unit is the mile (or rather its equivalent upon the map) then the grid should be numbered in miles ; but as they will be reckoned from an arbitrary zero, it seems unnecessary to label them East and North, because that provokes questions about the arbitrary zero, best left unasked. Sufficient to print on each sheet that on the arbitrary scale the coordinates of St. Paul's or Charing Cross are so and so. The numbers should, I think, be engraved within the outer margin, or they look like an addition to, instead of an integral part of, the map ; and they should take precedence of the division in latitude and longitude. But this latter division should be retained ; and I think that it would be well if the precise geographical coordinates of the sheet corners were engraved at the corners, which would give information that has never so far been obtainable for British maps, and is useful in teaching. These coordinates depend, of course, upon the projection : a subject on which there is much to be said, but which is out of bounds on this occasion.

The grid introduces (or brings more conspicuously to light) a third kind of north : grid-north. It is desirable that the angular deviations of true and magnetic north from grid-north should be engraved on the east and west margins of the sheet, in figures rather than in the diagram hitherto used. The diagram was never big enough to measure accurately, and it was in the past sometimes found to be more conventional than accurate. A plain statement of the figures will perhaps in time eradicate the notion that the edges of O.S. sheets are " practically " north and south.

The civilian sometimes wants to lay out a meridian or other true bearing ; and developments of direction-finding and similar refinements of wireless may very likely increase the need for calculating azimuths. The grid, rightly and cautiously used, will assist. And similarly, calculations of the distances between coordinate points may become more common in future than they are now. But the principal use of the grid in civil life will be, I think, for convenient reference. We may look forward to the time when every signpost, bridge, railway station, post-

office, church, police-station, and letter-box throughout the country, every lamp-post and street corner in town, has an abbreviated map reference painted upon it; when all postal guides, directions, and every kind of summary of local information prints the grid references of post-offices, public telephones, fire-alarms, ambulances, or police-stations; of museums, theatres, libraries, banks, doctors, and dentists, and what not. The applications to local administration would be endless. There are many private addresses that badly need a map reference; and not a few public buildings. The advantages are perhaps most conspicuous in great centres of population; but they are no less real in the country. Properties for sale, historic buildings and ancient monuments to be scheduled, fossil or plant finds to be recorded, soil and mineral and water surveys to be indexed; they all come within the scope of a grid, and call for its establishment.

And may a civilian end by expressing the hope that one grid may be found sufficient for both military and civil needs? It is possible that the requirements of air defence may be the deciding factor, and that the great distances involved may require the mile rather than multiples of yards or feet.

In the above notes I have argued on the assumption that British maps will remain in terms of British measures, which forbid any really logical system. So long as this is so, it does not appear to me that a grid in metric units has any substantial advantages sufficient to outweigh its disadvantages. If ever the maps of the Ordnance Survey were re-drawn on " natural " scales, the grids would almost necessarily be metric. But that conversion is probably distant, if one may argue from past experience.

Finally, I should say that I have tried to picture the needs and the conveniences of the civilian, without much consideration of what may in the end prove to be the compelling factor: the necessities of the soldier and of the surveyor. No one, I think, would advocate the expense of a double series of gridded maps: one for civil and one for military use. And if military necessity overrides civil convenience, it will not be a great matter for the civilian. The primary need is the grid for reference, and the unit of measure of the grid is secondary. But if there should be a balance of opinion on the military question, then the civil convenience may turn the scale.

Before the papers the PRESIDENT (the EARL OF RONALDSHAY) said: The question for discussion this afternoon is that of the choice of a grid for British maps, to be dealt with by three speakers. Colonel Winterbotham will open the discussion and will deal with the question largely from a military point of view, and, what is of importance perhaps to some of us who are present this afternoon, he will explain precisely what a grid is. Then Colonel Jack will continue the exposition of the subject and will, naturally, deal with it largely from the point of view of the Ordnance Survey and discuss the type of grid

which might conveniently be introduced in the case of Ordnance Survey maps. Finally, Mr. Hinks will have something to say upon the matter, dealing with it from the point of view of the intelligent layman, and he will suggest to us those points which are likely to be of chief interest to the ordinary civilian user of maps. With these very few words of introduction I will now ask Colonel Winterbotham if he will open the discussion on the subject.

The papers printed above were then read, and discussion followed.

Sir CHARLES CLOSE : I have had the opportunity of reading the papers by Colonel Winterbotham, Colonel Jack, and Mr. Hinks, and I think I occupy a sort of midway position. In these papers some of the considerations affecting the construction of a grid have been clearly put ; but there are some others that might be emphasized. My own belief is that the public does not use the existing grid on the small-scale maps. That grid was put on for military needs and fulfils no civil purposes. It might be used if there were an index of names accompanying each sheet, as was suggested some years ago, though the war interfered with the carrying out of the project, so that there is now no such index. It also appears, from a civilian point of view, quite immaterial what the size of the grid square is. In fact, I doubt if the grid is used to measure distances, whilst on the 1-inch map the size of the grid is not mentioned on the sheet. The existing grid was put on entirely at the instance of the surveyors, there being no civil demand for it.

It is not possible to have a grid which will serve the purposes of small-scale maps and of large-scale maps, unless it is drawn askew on the large-scales. I mention that because Mr. Hinks quite naturally spoke of the convenience that would ensue if we had a system of coordinates for general maps. The large-scale maps, that is the 6-inch and 25-inch, are plotted on a large number of distinct meridians. Before the war we were reducing the number of those, but there are still in use in Great Britain some thirty-five distinct meridians on which the large-scale maps are plotted.

As regards small-scale maps the question of the grid is difficult to free from that of the projection, though I believe we have been warned that we may not say anything about the projection. Nevertheless, an opportunity may occur in the course of a few years of considering the question of the small-scale projection, and I should, therefore, like to say a few words on both subjects. The small-scale maps of Scotland are—or were, with the exception of the ¼-inch—plotted on Bonne's projection, and those of England and Wales on the projection by rectangular coordinates. You cannot fit the old-type 1-inch maps of England on to the 1-inch maps of Scotland. There is, of course, no difficulty in plotting Great Britain on one projection. Now, if, as appears to be the case, military requirements demand an orthomorphic map, the matter is very simple. The adoption of a transverse Mercator's projection along some selected meridian would give rise to scale errors of about the same size as those of the existing maps, only the error would be in two directions instead of one. The best central meridian would be that through Delamere Forest, or the meridian 2° W. of Greenwich—it is not very material which. We could put a negative error along this meridian and halve the maximum error, which would then be in the neighbourhood of 1/2000 ; that is, the maps would have a smaller maximum linear error than they have at present, and no local angular error. Then the grid could be continuous.

As regards the size of the grid, I am in favour of 10,000-yard squares with subdivision into 5,000 yards ; ten of these subdivisions would go to the

length of a sheet, and six or seven to the depth; or, if the three to two proportion is still desired, the sides could be nine and six. The existing 1-inch sheets are awkward as to length and depth; 47,520 yards by 31,680. An origin for numbering the grid would, of course, be chosen, as has been mentioned by Mr. Hinks, well to the south-west or south-east to avoid changing sign.

I believe that the alteration of projection and the adoption of a general grid for small-scale maps, in the strict sense, would be to the good from every point of view, and I do not think it would affect the public use of maps at all. But as regards the large-scale maps the matter is more difficult, although, of course, it would be possible to plot the orthomorphic grid on the large-scale Cassini. Nevertheless it would be rather cumbrous to look at.

Major-General Sir JOHN T. BURNETT STUART: I have a shrewd suspicion that I have been produced here by Colonel Winterbotham as a sort of military exhibit to illustrate the interest which the General Staff takes in the national grid. If so, that is a very proper use to have put me to. Exact systems of map reference are of the utmost importance to soldiers, and I often wonder how we got on for so long without them; and if the Ordnance Survey can superimpose on their wonderful maps a national system of reference like that just described to us, I can see all sorts of ways in which it would be of the greatest use to the public as well. The ordinary citizen will not get used to it all at once, of course, and he may even look askance at it to begin with. It will be some time, I think, before the soldier can with confidence invite his young lady to meet him at 206,793 at 2020 hrs. But that will come in time.

Apart from the fact that a universal adoption of gridded maps will save the Army the expense of producing them specially for themselves, anything which brings ordinary public demand into line with the requirements of national defence is to the advantage of all of us. We have learnt by bitter experience what a national war means, and if war comes again—which it may do, however much we may try to avoid it—any knowledge of military value, such as accurate map-reading and reference, which the citizen can bring with him when called on to defend his country, will help us to carry on.

Mr. G. S. LAIRD CLOWES (Survey of Egypt): To a stranger who has just come from a metric country this discussion has been extraordinarily interesting as exemplifying the endless difficulties involved in the use of decimal measures to meet the requirements of modern life. It is not a question whether the metre or the kilometre is a more convenient measure than the yard or the mile, but this whole discussion has really turned on the difficulties caused by the inconvenient relationship of the inch to the mile and the mile to the yard.

In the Survey of Egypt, very soon after the late war, it was decided that future maps should be gridded. With metric maps it was obvious that the unit of the grid must be the kilometre square with appropriate multiples and sub-multiples according to the scale used. After that, all that was necessary was a small amount of discussion as to the most convenient origin, the best positions for reference numbers, and such details. Further, the fact that the grid and the maps are metric and consequently decimal, has enabled Egypt to dispense with the old complicated key-maps, one for each scale, and the old method of numbering, also different for each scale. Under the grid system each map is named by the coordinates of its south-west corner, and one small-scale skeleton map with its grids forms a key-map for all maps on all

scales. A point whose coordinates are, for example, 1234 in one direction and 5678 in the other lies on sheet 12–56 of a smaller scale and on sheet 123–567 of a larger scale.

But now to leave Egypt and the easy way and to get to the question of a grid of England. Surely the only cause which could be so potent as to induce the Ordnance Survey to change its system of sheet-lines and re-draw its maps would be the demand either by the Army or civilians for maps on decimal or so-called "natural" scales. Until such a change should become necessary the question, surely, is simply the application of a grid to the existing Ordnance sheets as they stand.

The example of a 10,000-foot grid, which has been described to us by Colonel Winterbotham, would seem to have been chosen so that the facts might be stated with a complete absence of bias, for it is a grid which would seem to have no attractions for either the soldier or the civilian. I can only imagine that it might be supported by builders when they have learned the use of grids. Does not the question really lie between a mile-to-the-inch grid, which will fit the existing sheets and of which a skeleton already exists in the form of the 2-inch reference squares, and the 10,000-yard grid, which will give distances in a unit convenient to the Army? From all we have heard this afternoon, I think this last is a statement which may fairly be made. The mile grid gives distances in a convenient unit for civil life, but how often does the civilian want the difference between two points as the crow flies? Surely it is the road distance which he much more often requires, and on the Ordnance 1-inch maps that is given by the milestones on the main roads. To my mind, those milestones also form a scale conveniently distributed over the map and more convenient for approximate eye-measurements than the existing 2-mile squares, which last can only be used for eye-measurements in the direction of the cardinal points. Sir Charles Close has already told us that the introduction of these squares was a purely military measure, so I do not think I need say anything further about their civil importance. I had already noticed that they had only comparatively recently been introduced into the Ordnance maps, and that in the maps of Scotland they did not traverse the whole sheet.

Further, in some of the latest Ordnance maps the 2-mile squares do not exactly fit the sheet, or rather there is a row of half-squares down one or both sides. The fact that these sheets have been produced without objection ought to dispose, to some extent, of the suggestion that a grid, such as the 10,000-yard grid, which does not fit the sheet, would interfere with the popularity of the maps amongst civilians. Almost every atlas one opens has a different manner of subdividing its sheets for reference and a different method of reference to those subdivisions. Sometimes there are two numbers, sometimes two letters, and, more commonly, a combination of number and letter, but I defy any one present to tell me on what part of an unknown sheet the square E–10 or 5–8 will lie.

In view of this diversity and of the great adaptability shown by the man in the street in absorbing these different systems, may we not hope that he will in time be able to absorb and use for reference a system of 10,000-yard squares with coordinate numbering? I say advisedly "use for reference," for that is what civilians use squares for. One can believe that in a few years' time a man might say that his house lies in square 572–873; but from that to the stage where a certain lamp-post is normally referred to and identified by its exact coordinates, correct to yards, is a very far cry! So as it is the

yard which suits the Army as a measure of distance, and as it is to the fighting services alone that the maps of England can ever be of really vital, life and death importance, I as a civilian submit that the grid should be the 10,000-yard grid.

Colonel F. W. PIRRIE: I agree that the 10,000-yard grid seems to be the most suitable, subdivided according to the scale of the map. During the War I spent some years in Mesopotamia, and many officers came to me and said, "What is the true North on this squared map?" and it was often impossible to reply without reference to triangulation records or taking local observations for azimuth. In the case of all maps where latitude and longitude lines are not shown at intervals in addition to the grid, unless steps are taken to enter along the marginal lines and also along the central vertical line the true bearings of these lines, it is impossible for officers to find out readily and quickly what is true North at different localities in the sheets. I did not have any access to the letterpress of the papers, so it is impossible for me to say more. I can only add that I think that if we have a yard grid it will be a stepping-stone to a metric grid, if we require one later on. I think it would be a mistake to introduce a metric grid at the present time, because people are not accustomed to it.

Colonel WINTERBOTHAM: May I refer to two points which have arisen? We were told that a foot-grid could not have been suggested by a soldier. I suggested it myself! As a matter of fact, the War Office is quite ready to adopt a grid based on that unit, because the unit of the grid is not of intrinsic importance to the Army at large. Very few during the war used the grid as a measure from one point to another on the map, because, as was ably said by an earlier speaker, you very seldom do lie east or west or north or south of the point to which you want to get the distance. The unit in which the grid is defined is not then of vital importance to the man who is giving or reading a reference. The choice must in fact be dictated by the surveyor. In military work the grid is extraordinarily useful in so far as it helps the gunner or the sapper to do his local surveys, perhaps for gunnery purposes, perhaps for some engineering undertaking, and to fit them into the existing trig. work of the area of operations. It is a unit suitable for such purposes which is wanted for a national grid. The foot is the national survey unit, but if it suits the Ordnance Survey and the civilian better to use yards, then we shall be willing to have the grid in yards. All we want to do is to get a grid which soldiers and civilians alike can use, so that if the occasion arises we shall all of us know all about it.

The PRESIDENT: If no one wishes to add anything further to the discussion, I will express the gratitude of the meeting to Colonel Winterbotham, Colonel Jack, and Mr. Hinks for the lucid manner in which they have put these questions before us, each from his particular point of view. Colonel Winterbotham has dealt with the matter mainly from the military point of view, and nobody, I feel, can have any doubt as to the essential importance of a grid to the Army. My own feeling with regard to the man in the street is that he will require a good deal of educating in the matter before he takes very kindly to a national grid. It is quite true that his spokesman this afternoon, Mr. Hinks, discoursed with great intelligence upon this subject, but I think the man in the street who listened to his mouthpiece must have felt as gratified as surprised at the knowledge which he possessed of the subject. No doubt the time may come when the man in the street will see the practical advantages of the use of this particular device to assist him in reading his

map, but, as I say, I think that time has hardly come yet. Therefore I am sure that the discussion this afternoon has done a good deal to throw light upon this subject, and we have certainly had interesting points of view placed before us in connection with it. Every one here is most grateful to the three authors of the joint paper for the time which they have given to placing it before us, and I express our gratitude to them.

THE GEOGRAPHICAL WORK OF THE CANADIAN ARCTIC EXPEDITION

WE have received from Mr. James White of Ottawa a letter printed below (No. I), criticizing the geographical discoveries made by Mr. Stefansson. He had courteously sent a copy of his letter to Mr. McDiarmid, so that his reply (No. II) might be printed in the same number of the *Journal*.

In view of the importance to the Canadian Arctic Expedition of the questions raised by Mr. White, the whole case has been carefully examined, and we believe that the Memorandum printed below (No. III) is an impartial and fair summary.

I. LETTER TO THE EDITOR, *GEOGRAPHICAL JOURNAL*, FROM MR. JAMES WHITE

Your October number contains an article by Mr. F. A. McDiarmid entitled *Geographical Determinations of the Canadian Arctic Expedition*. The author not only sets forth the methods used in determining longitude, latitude, and azimuth, but also makes certain statements respecting earlier discoveries. To some of these statements the writer takes exception.

First: On p. 298, Mr. McDiarmid says, "Brock and Borden islands are new discoveries; the only marking on any of the older maps at all close to these islands is Ireland's Eye, a small island or reef; but, from the description in Captain McClintock's diary of the island [Ireland's Eye], he cannot be describing Brock or Borden islands."

Mr. McDiarmid then quotes from McClintock's log, but omits certain pertinent passages quoted below.

McClintock states under date 14 June 1853: "None of these islands are more than 60 feet high; they are entirely composed of gravel. Saw many small pieces and a few large lumps of grey gneiss upon all parts of them. On the beach were many bivalves and a few spiral shells. . . . Along the south-west sides of the islands and from one to two miles off was the edge of very heavy packed ice. . . . Across the centre of the second island off the coast, and on which we built our cairn, the land is scarcely above the sea."

The tenor of McClintock's statement absolutely demonstrates that the above extract refers to what he calls, in his log, "First" and "Second" islands, and that it has absolutely no reference to his Ireland's Eye island. His chart shows his route and demonstrates that he was never within 10 geographical miles of Ireland's Eye island—this distance being measured on Stefansson's map. Furthermore, the way in which McClintock indicates Ireland's Eye island shows that he only saw the nearer and lower portion of it, the remainder being hidden by fog.

It cannot be seriously contended that atmospheric conditions on 14 June 1853 permitted McClintock to identify "bivalves" and "spiral shells" at a distance of 10 miles unless the protagonist of this theory is prepared to contend that the conditions on that day constituted the most remarkable phenomenon since Joshua made the sun stand still.

The distance and bearing of Ireland's Eye island from Prince Patrick island, as charted by McClintock, prove that the former is identic with Stefansson's "Brock" island.

Further, how can any one contend that the weather was so clear that McClintock could see an island or reef so small that Stefansson did not indicate it on his map, but was so foggy that he could not see "Brock" island, 300 or 400 feet high?

Second: Mr. McDiarmid says, "Findlay island as shown on Chart No. 2118 is a large island nearly 60 miles long and 40 miles wide lying in a north-westerly and south-easterly direction. Mr. Stefansson found across a large part of the area supposed to be covered by Findlay island a depth of 160 fathoms of water. There is a small island situated near the place where the north end of Findlay island was supposed to be."

The facts are that, in 1852, Osborn sighted land to the north of Bathurst island, and in 1901 Isaachsen and Hassel, of the Sverdrup expedition, sighted land to the *south* of Ellef Ringnes island. Sverdrup assumed that the land sighted by Isaachsen and Hassel was the northern extremity of that seen by Osborn nearly a half-century earlier and indicated it as such, though it is clear from his map that the joining of the two lands is only an assumption of probability. Pending the receipt of definite information, other geographers, including the writer, followed Sverdrup, but it was clearly understood that it was only a probability.

(*a*) Respecting Patterson island, Sherard Osborn, on 27 April 1853, when near the north-western extreme of Bathurst island, noted (p. 199) bearings on the "extremes of a new island since called Patterson island."

On 28 April, Osborn notes that he "Saw the New Island seen yesterday, bearing N.N.E., about 20 miles distant and covering 10° of the horizon" (p. 200).

From his camp April 28–29, Osborn notes that the "Extremities of Patterson island bear N. 5° W. and N. 3° E." (p. 200). In short, they subtended an angle of 8°.

To identify Osborn's "Patterson" island, it is necessary, therefore, to look for an island about 20 miles distant from his observation point on Bathurst island and covering 10° of the horizon. An examination of Stefansson's map shows that what he calls "Patterson" island subtends an angle of only 4°; that his "Grosvenor" island subtends an angle of 4½°; and that what he calls "Edmund Walker" island is 23 miles distant from Bathurst island, and covers 10° of the horizon. This amounts to a demonstration of the identity of Stefansson's "Edmund Walker" island with the "Patterson" island of Osborn.

(*b*) Respecting Findlay island:

On April 29, Osborn notes: "New Island [Findlay] was plainly discernable; in outline and colouring it resembled much the same lands seen by us in the autumn of 1852, and I doubt not forms a portion of the same archipelago of islets strewed over the Polar Sea."

Osborn also reproduces a sketch of this "New Island." The sketch shows that he saw New (Findlay) island with remarkable distinctness, and he shows the outlines of its topography in detail.

Proceeding by elimination, it is demonstrable from this sketch, from Osborn's statement quoted above and from the bearings taken by Osborn, that his "New" island is not his "Patterson" island, but is the insular area later known as Findlay island.

On April 29, from an eminence 100 feet high and 1 mile due south of his camp of April 28–29, Osborn notes: "Distant land, probably 30 to 35 miles distant bearing N. 21° W. and N. 37° W."

These bearings show that this "land" (Findlay Land) subtended an angle of 16°. Using Osborn's chart as a basis, it is found that an island of the length shown thereon will subtend an angle of 16° at a distance of about 27 miles.

It is necessary here to refer to an error in the charts which has been made the basis of a contention that "Lougheed" and "Findlay" are not identical.

On the *chart* of the coastline searched by Osborn, Findlay island is indicated as only 14 miles from the north-western extreme of Bathurst island instead of "30 to 35 miles" as estimated by him on April 29. Similarly, Patterson island is indicated as only 12 miles distant from Bathurst island, instead of 20 miles as noted on April 28.

Why were Findlay and Patterson islands indicated on the charts as being much closer to Bathurst island than Osborn estimated them to be? Pending an examination of Osborn's original chart, one can only speculate as to the reasons for these discrepancies, but it is a fair assumption that he was short of paper and had to shorten the estimated distances in order to bring them within the limits of the sheet. Such shortening of the distance would, of course, *increase* the subtended angle, and examination of Osborn's chart not only demonstrates that the subtended angles are much too great, but, on increasing the distance to agree with Osborn's estimate, the subtended angles are found to be practically the same as he has recorded in his log, which almost amounts to a demonstration of the accuracy of the assumption set forth above.

Furthermore, in identifying the features discovered by Osborn, the basis of the identification must be the bearings and estimated distances recorded in his log, irrespective of manifest errors that are found in the chart.

Thus an examination of the Osborn chart discloses the fact that Findlay Land as indicated thereon does not subtend an angle of 16°, as measured by Osborn, but subtends an angle of 30½°. If, however, the island as indicated on this chart be moved bodily to a distance of 27 geographical miles—the distance determined by Stefansson—it will then subtend the angle of 16° as measured by Osborn.

Finally, an examination of Stefansson's map discloses (*a*) that what he calls "Lougheed" island subtends an angle of 21° and is 27 miles distant; and (*b*) what he calls Edmund Walker island subtends an angle of only 10° and is 23 miles distant.

The foregoing demonstrates that the "Lougheed" island of Stefansson is the Findlay Land of Osborn, and that the "Edmund Walker" island of Stefansson is the Patterson island of Osborn.

In this connection it is interesting to note that, on April 29, from the "eminence 100 feet high," whence Osborn took bearings on Findlay island, he also saw "Distant land bearing N. 37° W." Later, in the same day, he says that he "distinctly saw land looming" about "30 miles to the N.W. (*or more*)."* His sketch of Findlay island shows that the weather must have been remarkably clear; this "distant" land was so distant that it only

* The italics added by the writer.

"loomed"; whereas Findlay island, at a distance of 27 miles, was very clearly seen. Osborn also says: "It appeared extensive, and I took the bearings of two remarkable parts of it and not the extremes."

There can be little doubt that the land Osborn saw "looming" in the north-west was the insular area named "Borden" island by Stefansson. As to the possibility of seeing Borden island, it is only necessary to quote Stefansson p. 546, where he says that from Findlay ("Lougheed") island he obtained "bearings of two or three points on Borden island." Also, on April 29 Osborn says that "to the S.W. we saw for the first time the distant shores of Melville Island, 40 miles distant"—an additional proof of the wonderful clarity of the atmosphere on that day.

Summing up, we find:

(1) "Brock" island of Stefansson is the island named "Ireland's Eye" by McClintock.

(2) "Lougheed" island of Stefansson is Osborn's "Findlay Land."

(3) "Edmund Walker" island of Stefansson is Osborn's "Patterson" island.

(4) On 29 April 1853 Osborn saw Borden island "looming" in the north-west.

While on the subject of corrections, attention may be drawn to an inaccurate statement in Stefansson's 'Friendly Arctic,' p. 261.

Referring to the west coast of Banks island between Burnett bay and cape Kellett, he says: "Investigations since made at my request by the Royal Geographical Society indicate that some of this map was based not on any survey or sketches made at the time, but on log-book entries, narratives, or possibly even the memoirs of men who were on the journey. Nothing more than a very general correspondence between the facts and such a map can be expected."

Mr. McDiarmid, following Mr. Stefansson, says, p. 298, that "the original map of the coast by the McClure party was made sone time after the visit and the details were filled in from memory."

An inquiry addressed to the Hydrographer brought forth a reply dated 22 March 1922. The Hydrographer states that there is, in the Admiralty, the "original chart deposited in the Admiralty showing the land discovered by H.M.S. *Investigator* 1850–52, Commander Robert McClure." The Hydrographer's letter demonstrates that "this chart was used in the compilation of the Admiralty chart," and that said chart was not based on any "log-book entries," "narratives," or "memoirs of men who were on the journey."

JAMES WHITE.

Ottawa, 15 December 1923.

II. REPLY TO MR. WHITE BY MR. F. A. MCDIARMID

Some time ago I received a letter from Mr. James White, Technical Adviser to the Minister of Justice, with which he enclosed a letter he had written you criticizing some parts of my paper "Geographical Determinations of the Canadian Arctic Expedition" published in your *Journal* in October. Mr. White is one of our foremost authorities in things geographical, and I hesitate to put my opinions against his. In fact, I will not do so; but I should like to point out why I reached the conclusions set forth in my paper.

First, regarding Brock and Borden islands and Ireland's Eye I quoted from McClintock's log of date 14 June 1853, where he points out the small elevation of the islands described. Mr. White claims these islands so described

are "First" and "Second" Islands and no reference to Ireland's Eye. Mr. Stefansson, in a letter to Mr. T. H. Parker of this office, says there is an isolated island to the south or south-west of False Island Point which he takes to be the Ireland's Eye of the map. I would also refer you to your letter to Mr. Stefansson of 21 May 1920, where in (1) you say, "Ireland's Eye" is referred to in the paper by McClintock "Reminiscences of Arctic Ice Travels in Search of Sir John Franklin and His Companions" in the *Journal* of Royal Dublin Society, February 1857, where you find on p. 46: "From the 12th to the 15th of June we were examining the Polynia islands, the northernmost of which I named Ireland's Eye. It lies almost under the 78th parallel. None of these islands are more than 60 feet above the sea. They are entirely composed of gravel. On searching about I found a few large pieces of grey gneiss in small fragments, some light-colored quartz and granite."

The Brock and Borden islands of Stefansson are large islands many miles in extent, and have elevations rising several hundred feet above the sea, notably Leffingwell Crags, which has an elevation of some 1500 feet.

(2) Findlay Islands.

The explanation of the error on the map regarding Findlay Island given by Mr. White in his letter to you is practically the same as that of Mr. Stefansson and myself, but Mr. Stefansson claims the smaller islands to the south are new discoveries. You have the authorities on Arctic Explorations; I would ask you to be good enough to look into the matter. My only concern was to map the different islands as closely as possible from the information supplied in Stefansson's Diary. On the chart No. 2118 Findlay is the name of the large island. Mr. Stefansson has found instead of one island there are several, and the name Findlay Islands has been given to the group and the separate islands named as shown on the Stefansson map.

If Mr. White's contention that on account of lack of paper the Findlay group is shown nearer to Bathurst Island than Osborne estimated them to be is correct, surely some reference would be made in the log to that fact.

(3) Banks Island.

My reasons for referring to the map of this island being drawn from memory some time after the journey were based on your letter of 21 May 1920, where in (2) is the following quotation:

"(2) The detail upon the Admiralty chart appears to be copied from the maps made by Arrowsmith, especially that which illustrates the North-West Passage, Capt. McClure's despatches from Her Majesty's discovery ship *Investigator* off Point Warren and Cape Bathurst, London, John Betts, 1853. On p. 34 there is some account of the examination of the part of the coast about Cape Crozier. They speak of thick fog with hail permitting a very circumscribed view, and their attention appears to have been directed eastward, but I do not think that is sufficient to account for missing the big bay to the west. Arrowsmith's maps seem to have been made up partly from accounts rather than from surveys, and I think that they are the real origin of the fanciful detail."

I will further only refer to the changes made on the coastline of Banks Island by the Stefansson party. His several diaries have been carefully followed, and either they are a matter of imagination or the mapping of the several islands is substantially correct. Yet, as Mr. White has given this matter a great deal of study, I would ask that you have these several matters and changes carefully

gone over, and if my conclusions are in your opinion wrong I shall be glad to hear from you. I am sending a copy of this letter to Mr. White.

F. A. McDIARMID,
Geodetic Survey of Canada.

III. MEMORANDUM ON THE DISCOVERIES OF THE CANADIAN ARCTIC EXPEDITION

The question raised in Mr. White's letter as to the novelty or otherwise of Stefansson's discoveries, and the extent, if any, to which they have been ante-dated by those of former explorers in the same region, have been investigated with the assistance of all relevant original documents that are preserved. All available publications have also been consulted, including the series of Parliamentary Blue Books in which the reports of the various Arctic expeditions of 1848–1855 were published, Sverdrup's *New Land* (translation) containing the account of the *Fram* expedition of 1898–1902, Stefansson's books, in particular 'My Life with the Eskimo' and 'The Friendly Arctic,' and a large number of other works, both narratives and compilations.

The authorities accepted in this investigation for the various chartings of the region in question at different dates and in different localities are as follows:

For British work up to 1855—original charts—the charts published in the Blue Books, and the Admiralty charts of the period.

For Sverdrup's work—the charts issued in his book, referred to above.

For Stefansson's work—the charts issued in his 'Friendly Arctic,' the small map published in the *Geographical Journal* for October 1921, and reduced photographic copies of the charts issued by the Geodetic Survey of Canada.

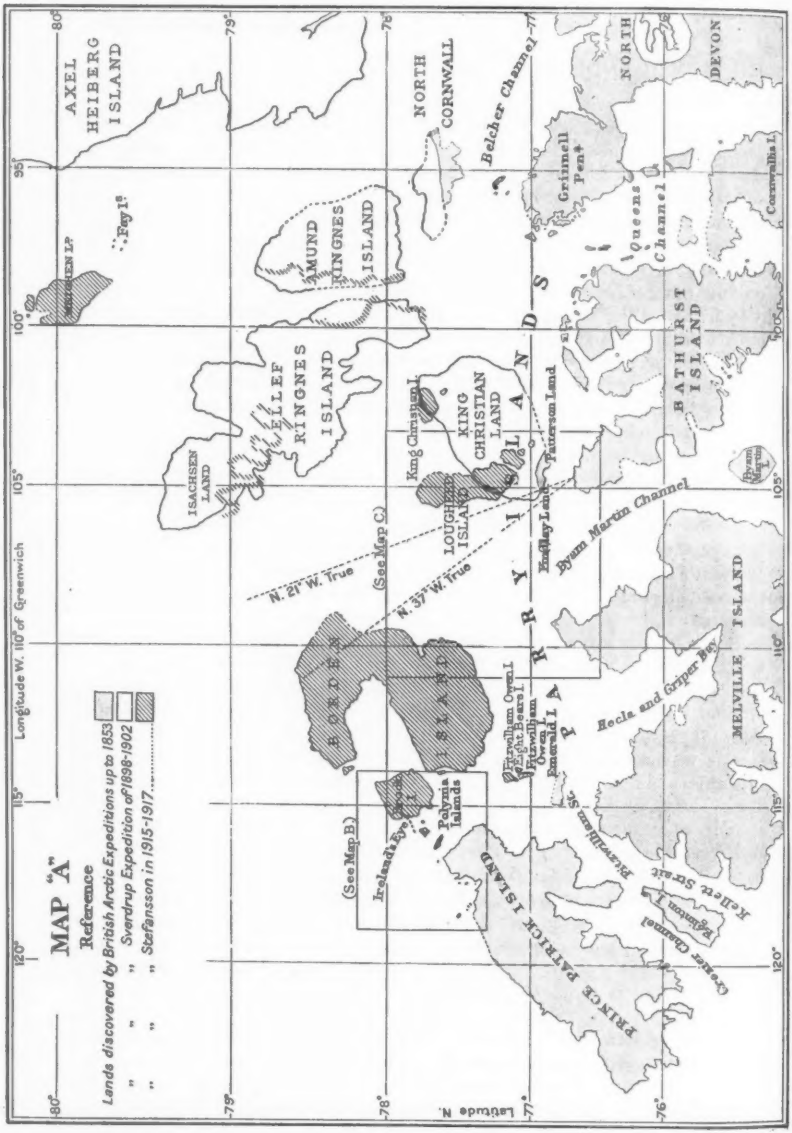
Four sketch-maps, marked A, B, C, and D, have been prepared to facilitate the comparison of Stefansson's chartings of various areas with those previously accepted.

The questions involved will be best appreciated by reference to sketch-map A, which shows the portion of the Canadian Archipelago between 75° and 80° N. and between 90° and 125° W., and indicates by its shading the extent of the original discoveries effected by various expeditions. The portions of land shown in stipple were, with the exception of a small part of Melville island previously traversed by Parry in 1820, all discovered by the Franklin Search expeditions under Austin (1851–52) and Belcher and Kellett (1853–54). Those shown in outline are due to Sverdrup's expedition in the *Fram* (1898–1902). Those hatched were discovered by Stefansson in 1915–17. All were laid down as the result of sledging expeditions—directed, it should be remembered, in the case of the Franklin search-parties, not to geographical exploration but to the discovery of traces of Franklin and his men. The expeditions of Sverdrup and Stefansson, on the other hand, were designed solely for the purpose of geographical exploration. Still, it may be asserted with tolerable confidence that the work of the British expeditions stands, as far as geographical accuracy is concerned, on a very similar footing with that of the later explorers.

It will be seen that Stefansson's discoveries lie amongst those of his two predecessors, and, in several instances—Brock, Borden, and Lougheed islands—not far from them. The question of whether, or how far, his discoveries have been ante-dated by his predecessors was therefore more or less bound to arise, although of only moderate geographical importance.

Mr. White's contentions are as follows:

1. That Stefansson's "Brock island" is the small islet named "Ireland's Eye" by McClintock (Commander—afterwards Admiral—Sir F. L. McClin-



Sketch from Admiralty Chart No. 2443, extended to the northward, showing the progressive stages of the exploration of the Parry Archipelago.

tock, R.N., of Kellett's squadron), and was seen by the latter from the north-east extremity of Prince Patrick I. (Sketch B).

2. That "Lougheed island" of Stefansson is "Findlay land," whose sighting and charting he (erroneously) ascribes to Sherard Osborn (Lieutenant—afterwards Rear Admiral—Sherard Osborn, R.N., of Belcher's squadron) (Sketch C).

3. That Stefansson's "Edmund Walker island" is "Patterson island" (also incorrectly ascribed to Osborn).

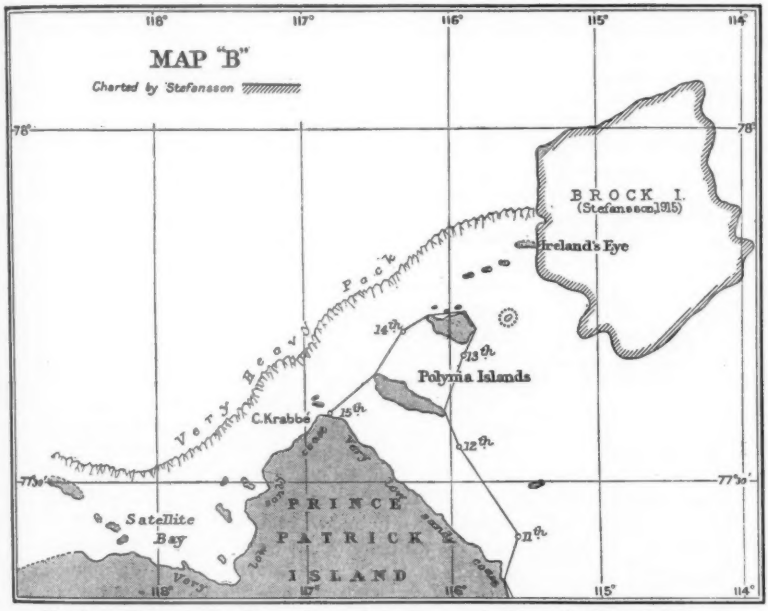
4. That Stefansson's "Borden island" was sighted by Osborn from the north-west extremity of Bathurst island (Sketch A).

5. That Stefansson has incorrectly described McClure's chart of Banks island as inaccurate and partly compiled from memory (Sketch D).

Notes on these contentions are subjoined.

1. That "Brock Island" is McClintock's "Ireland's Eye."

Sketch B shows a portion of the published chart accompanying McClintock's journal in the Blue Book. It may simplify matters to explain here the methods adopted for working up and publishing the results of the Franklin Search



Sketch to illustrate the discoveries made by Commander F. L. McClintock, R.N., in 1853, at the north-east extremity of Prince Patrick Island and his approximate route; and Brock Island discovered by Stefansson.

expeditions. While in the field under Arctic conditions of weather, it was, of course, impossible for the officers of sledging expeditions to plot their explorations on the spot—nor, unless (as was not often the case) they were trained surveyors, could they be expected to work up their material to the best advantage after their return to their base. The field-notes, astronomical observations, dead-reckonings, etc., brought in by the sledging parties were therefore written up by such officers and delivered to the Commanding Officers of the expeditions,

who might either work them up themselves, detail a qualified officer (sometimes their author) to do so, or retain them for examination in the Hydrographic Department after the expedition's return. A similar plan was followed with regard to the journals of all officers composing the expeditions, which, in accordance with a long-standing practice, were given in to the Commanding Officer at or before the close of the voyage, and returned to their authors after the Admiralty had copied, for reference, all valuable matter contained in them.

In the case of the Franklin Search expeditions, the results of such examinations were, in view of the great public interest attaching to the work of the expeditions, speedily published in very great detail in the Blue Books, accompanied by charts constructed in one of the ways referred to above. These charts therefore contain the considered conclusions resulting from an expert contemporary examination of all the available data, and are thus, paradoxical though it may appear, more authoritative, in the majority of cases, than the charts, if any, drawn by the explorers themselves. In a similar manner, the information in the Blue Books represents the valuable residue arising from a critical examination of a very large amount of MS. matter, much of which is no longer available, since the journals, being the private property of their writers, and not required, by the Regulations, to be sent to the Admiralty for retention (as in the case of a ship's log) were subsequently returned to them. Thus, McClure's journal was afterwards prepared for publication by Sherard Osborn, who also published his own journals, while McClintock's is in the possession of his family. With regard to the charts, it is uncertain, in many cases, whether any chart was actually made by any particular explorer—or, if so made, what has become of it. If he were a surveyor, or if there were some particular circumstance attaching to the geographical discoveries (as in the cases of Richards and McClure, referred to later), the chart might be preserved at Admiralty. If returned to the officer, its whereabouts are, of course, uncertain ; while, if merely worked up fron his results by another hand and then engraved and published by the Admiralty, there would be no vital necessity for preserving it after the publication of the chart.

In the present case, therefore, the chart and accompanying extracts from McClintock's journal published in the Blue Books form the principal authority upon which a judgment can be formed. The sketch-map reproduces a portion of the chart, the only additions being the approximate outline of Stefansson's " Brock island " and a dotted ring to distinguish one of the smaller islets.

Now, whether McClintock did or did not see a portion of Brock island, it is apparent, both from his chart and from the statements in his journal (amplified by the extract from his paper referred to by Mr. McDiarmid in his rejoinder), that he had no conception of the existence of any large island in the vicinity. The extract referred to disposes of Mr. White's contention that McClintock, in his journal, was not referring to " Ireland's Eye " when he stated " . . . none of these islands are more than 60 feet high. . . ."

Mr. White's remark that " . . . the way in which McClintock indicates Ireland's Eye island shows that he only saw the nearer and lower portion of it, the remainder being hidden by fog " is not warranted by the chart itself. The representation of " Ireland's Eye " clearly indicates, in the customary manner used then and now on the Admiralty charts, a small island whose extent has been ascertained by angles from various points, but whose further shore has not been actually surveyed or is actually visible, although its general position and the limits within which it must lie are known. The remark, " The distance and bearing of Ireland's Eye island from Prince Patrick island, as charted by

McClintock, prove that the former is identic (*sic*) with Stefansson's 'Brock' island" is not understood. It might be contended with some show of plausibility that "Ireland's Eye" was in reality a portion of Brock island, the remainder of which was veiled by fog; but McClintock's chart certainly does not *prove* this: if the chart and journal prove anything, it is that in the space between Brock and Prince Patrick islands there is an archipelago of small islets, extending almost from one to the other, of which that nearest to Brock island is "Ireland's Eye."

It is not, of course, likely that McClintock's and Stefansson's positions of, say, Cape Krabbé, exactly agree; but the discrepancies are probably not great, as evidenced by the position of Stefansson's observing spot in Satellite Bay given in Mr. McDiarmid's article. One might expect McClintock's longitudes to be slightly in error, as at an earlier period of his journey he allowed his pocket chronometer to run down and apparently assumed that it would have the same rate after re-starting, which is questionable. Stefansson's charted position of Fitzwilliam Owen island agrees with McClintock's for longitude, but is about 6 miles further northward. If Brock island be displaced this amount on McClintock's chart, the question as to the identity of "Ireland's Eye" remains unaffected, while the south-west point of Brock island would then be situated about 2½ miles eastward of the small islet marked with a dotted ring. It must be remembered that McClintock had foggy weather, and notes in his journal that he lost sight of this particular islet while advancing to the "second island" (the "farthest north" point reached by him on the journey).

Summing up, it would appear most probable that "Ireland's Eye" is a small islet westward of Brock island, and that while it may possibly have been a portion of Brock island, the balance of evidence is against this view. In any case, McClintock had no suspicion of the existence of any large island in this vicinity.

2. That "Lougheed Island" is "Findlay Land."

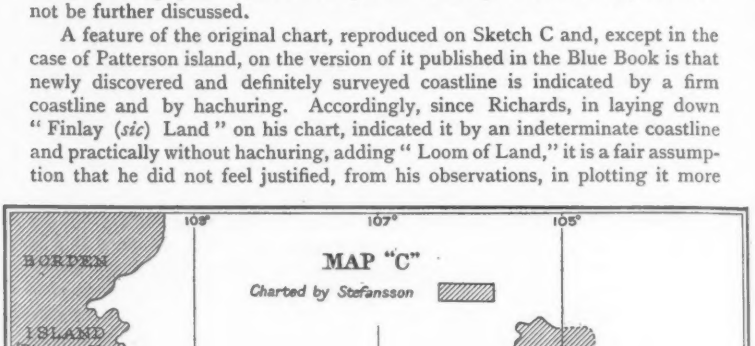
Before discussing points 2 and 3, it may be well to point out an error into which several Arctic writers, including Greely and Stefansson himself, have fallen, and which has considerable bearing upon Mr. White's contentions.

It has been generally supposed that when "Patterson island" and "Findlay land" were seen by Sherard Osborn the latter was in command of a detached sledging expedition, and that these discoveries should therefore be accredited to him. This is not the case. He was acting as second in command of that expedition, its leader, then in company with him, being Commander G. H. Richards, R.N. (afterwards Rear-Admiral Sir G. H. Richards, Hydrographer of the Navy from 1863 to 1874). Richards, it should be noted, was a very experienced surveyor, having been employed in that branch of the service for eighteen years. Osborn, on the other hand, was not a surveyor, and it may be pointed out that when, at a later period of the expedition, he parted company with Richards and proceeded independently, his geographical results became of somewhat doubtful value for several reasons, including a defective chronometer.

"Sherard Osborn's chart," to which Mr. White refers, is Richards' chart, and was drawn by that officer from (as far as can be seen) his own observations, without attempting to reconcile them with Osborn's. It should be studied in conjunction with Richards' journal, given further on in the same Blue Book, and not with Osborn's. The original MS. chart, signed by Richards, is preserved at the Admiralty.

It will be understood, from what has been said about chart work, etc., in connection with McClintock's chart, that Mr. White's suggestions as to Osborn being short of paper, etc., are based upon a misconception of the facts, and need not be further discussed.

A feature of the original chart, reproduced on Sketch C and, except in the case of Patterson island, on the version of it published in the Blue Book is that newly discovered and definitely surveyed coastline is indicated by a firm coastline and by hachuring. Accordingly, since Richards, in laying down "Finlay (*sic*) Land" on his chart, indicated it by an indeterminate coastline and practically without hachuring, adding "Loom of Land," it is a fair assumption that he did not feel justified, from his observations, in plotting it more



Sketch from original chart prepared by Commander G. H. Richards, R.N., showing the new land reported by him northward of Cornwallis Island (April 1853). The original only extends to 77° N. The sketch-map has therefore been extended to include Stefansson's "Findlay Islands" and part of Borden Island, shown hatched.

definitely. This point is further discussed in connection with Patterson island.

Sketch C shows a portion of Richards' original chart, to which has been added, shown hatched, the approximate positions of Stefansson's "Findlay group" and part of his "Borden island."

It appears not improbable, after examining Richards' chart and journal, that his "Fin(d)lay Land" was in reality the southern extremity of Stefansson's "Lougheed island," as Mr. White contends. In that case his name, in the form of "Findlay Island" should take precedence of Stefansson's.

3. That Stefansson's "Edmund Walker Island" is "Patterson Island."

The evidence afforded by Richards' chart and journal does not support this conclusion, but neither, it should be added, does it support Stefansson's identification of "Patterson island," as charted by Richards, with that of the same name charted by himself at the south-east extremity of the "Findlay group." The accounts of both Richards and Osborn show that this island was in sight on three separate days, and that its position was fixed by bearings on all of them, affording a triangulation in the form of an isosceles right-angled triangle in which the base line traversed by the party (some 15 miles and upwards) is at right angles to the initial bearing of the island, and approximately equal in length to its distance when first sighted. It is simply inconceivable that in such circumstances an error in fixing its position, of anything like the magnitude necessary to allow of its now being identified with Stefansson's "Edmund Walker" or "Patterson" islands, could possibly have been committed. Its southern portion, as indicated on sketch-map, was shaded in by Richards, showing that he felt no doubt as to the accuracy and completeness of his observations as to its position and extent—a marked contrast to his charting of "Fin(d)lay Land." Until the position charted by Richards is further explored (Stefansson did not do this) there appears to be no reason why it should not be retained on the charts in its original position, and shown as what it undoubtedly is, a small detached island.

In view of the foregoing, it is unnecessary to enter into a discussion of Mr. White's arguments for identifying it with "Edmund Walker island," further than to point out that Osborn's bearings cannot be reconciled with Richards' chart, and that they do not afford, in themselves, sufficient data for an independent determination of the positions of the land seen by him. It may also be observed that Mr. White's method of taking the subtended angles to the extremities of a point of land, and fitting them in anywhere with no regard to the azimuth upon which those bearings were taken, is calculated to give extremely fallacious results.

In passing, it may be observed that while the plan adopted in Sverdrup's chart, and subsequently upon the Admiralty charts, of combining "King Christian Land," "Findlay Land" and Patterson island into a single large island has been disproved by Stefansson's subsequent explorations, it was, at the time, supported by all the available data. Sverdrup's chart, it is true, showed all of them as connected by a firm and continuous coastline, and was therefore misleading, but on the Admiralty charts the connection was made by a pecked line, correctly indicating that while the connection was a probability it had not been absolutely determined.

4. That Stefansson's "Borden Island" was sighted by Osborn.

From Sketch C it will be seen that the distance from the nearest point of Bathurst island to the nearest point of Borden island is approximately 85 geographical miles.

When at Cape Dunvi, Osborn noted the bearings of what he described as two remarkable parts (not the extremes) of a distant land, 30 to 35 miles off, recording these bearings as N. 21° W. and N. 37° W. From the notes at the beginning of his journal, it seems probable, although he does not specifically say so, that these bearings are true—at any rate they cannot be magnetic. They have been plotted on Sketch A in dotted black line.

It will be seen from that sketch that the right-hand bearing, taken to a point *within* the right extreme of the "land," does not lie on any land what-

ever further away than "Findlay Land." The left-hand bearing cuts the coast of Borden island at a distance of approximately 105 geographical miles from the observer.

There appears to be, in view of these considerations, no reasonable doubt that this appearance of land was illusory, and probably due to a mirage or cloud resemblance.

5. That Stefansson has incorrectly described McClure's Chart of Banks Island as inaccurate and partly compiled from memory. (Sketch D.)

The full text of the remarks referred to ('The Friendly Arctic,' p. 261) is as follows:

"... The Admiralty chart proved rather inaccurate, as it had been made on the basis of observations from McClure's ship sailing along several miles from the land on its way north in 1851. Investigations since made at my request by the Royal Geographical Society indicate that some of this map was not based on any survey or sketches made at the time, but on log-book entries, narratives, or possibly even the memoirs of men who were on the journey. Nothing more than a very general correspondence between the facts and such a map can be expected.

"There are several islands along the coast, although only one, Terror island, is shown on McClure's chart.

"On the map the coastline is undulating, without deep bays or harbours; on the real land there are many deep bays and many harbours, if their entrances prove adequate when sounded. I am inclined to think, from the evidence of driftwood on the beach, that during the last short while, geologically speaking, the coast has been rising; but that before that there must have been a long period of considerable subsidence, and there are accordingly long arms of the sea stretching inland through 'drowned' valleys. Relying on the map, we tried for the first few days to follow the coast pretty closely, thinking there would be no deep bays or hindrances to travel, but we lost so much time this way that later we travelled on an average five miles away from the coast. ..."

These statements, which are in many respects inaccurate, are best discussed under two heads—the sources of the Admiralty chart, and its relative accuracy as compared with Stefansson's work.

Sources of the Admiralty Chart.

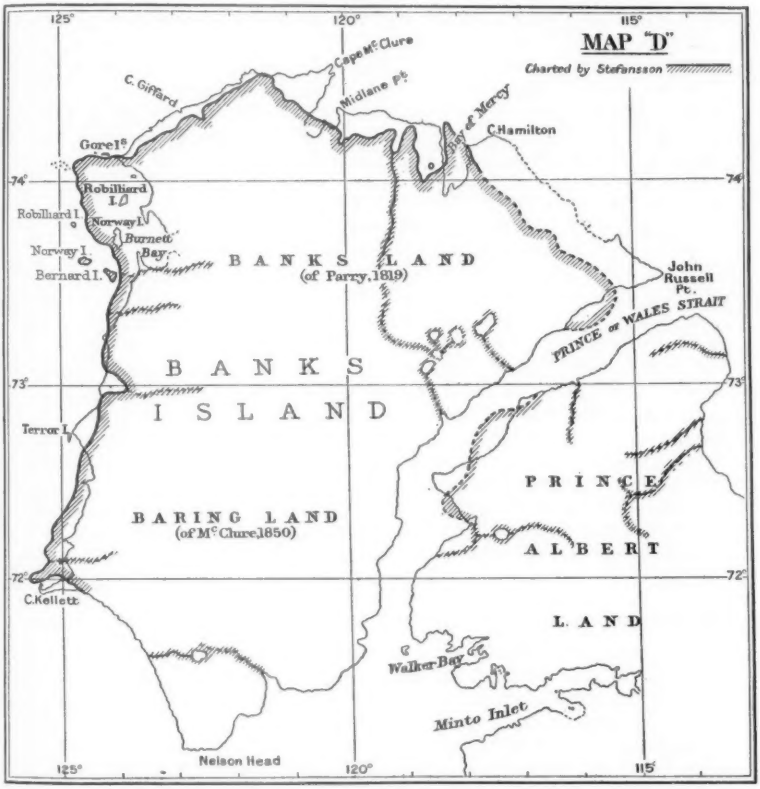
The Admiralty chart used by Mr. Stefansson, and frequently mentioned by him in his book 'The Friendly Arctic,' was No. 2118. The following remarks, however, are equally applicable, *mutatis mutandis*, to No. 2443, which is a similar chart of a smaller scale.

A drawing from chart No. 2118 is reproduced, marked D. This shows Banks island as now charted by Admiralty, and as it has been charted, without alteration, since its first appearance on this chart on 20 January 1855—less than four months after McClure's return from the Arctic.

Banks island was placed upon this chart from the MS. originals preserved at Admiralty. They embody the results of the running survey of Banks island made during the voyage of the *Investigator* by Stephen Court, 2nd Master R.N. (her navigator), and of the land explorations made by sledge parties during the spring of 1851, and comprise a fair track chart, in seven sheets, of the *Investigator's* route, the rough charts of three of these sheets, and four copies of a chart by Court showing the discoveries in Banks island and its vicinity. Of the last, three copies are by Court, and one of a later date,

by W. B. Shellabear, 2nd Master R.N. of H.M.S. *North Star*, of Belcher's squadron.

Of the three copies of his chart made by Court himself, the most interesting is one endorsed by Captain A. B. Becher, R.N., Assistant Hydrographer, "Recd. in the Hydrographic Office on the 13th of October 1853." From this date it follows that this chart was brought to England, with McClure's despatches, by Lieutenant Gurney Cresswell, R.N., of the *Investigator*, who left her, then in Mercy Bay on 15 April 1853, and reached England in H.M.S.



Sketch from Admiralty Chart No. 2118; showing Banks Island as it has appeared, without alteration, on that Chart since 20 January 1855, combined with Stefansson's new work.

Phœnix on 7 October 1853 with the news of the discovery of the North-West Passage. Peculiar interest therefore attaches to this chart by reason of the unquestionable fact that it was actually drawn on board the *Investigator* while locked in the ice in Mercy Bay, Banks island.

The north-east portion of Banks island was at once inserted, from this chart, on Admiralty chart No. 2118, and copies so corrected were published early in 1854, while the whole of Banks island, from Court's survey (slightly pruned

as regards detail, but without any subsequent additions or alterations whatever) was inserted upon the larger edition which appeared on 20 January 1855. Court's charting of Banks island has remained unaltered upon this chart ever since.

It is apparent then that there is no foundation for the statement that "... some of this map was not based on any survey or sketches made at the time, but on log-book entries, narratives, or possibly even the memoirs of men who were on the journey."

The responsibility for the statement is laid upon investigations made at Mr. Stefansson's request by the Royal Geographical Society, and we have carefully examined the extensive correspondence with Mr. Stefansson in 1920 upon which the passage is based. In a letter dated 3 May 1920 he wrote: "I have heard the story that when McClure arrived at Kellett's base on Dealy Island, after abandoning the *Investigator*, it was found that he had with him no map of the north coast of Banks Island, and that this map was made from memory either at Dealy Island or after the expedition returned to England," and he asked us to examine the question. At a first examination it appeared that the Blue Book of 1854 had been published without any chart. There was however the map by John Arrowsmith, published 16 November 1853, "drawn from official documents," in which the outline of Banks Land is identical with that shown on the Admiralty chart of the following year; and in a first reply of 21 May 1920 the Secretary carelessly suggested that "Arrowsmith's maps seem to have been made up partly from accounts rather than from surveys." Within a few days, however, we had procured for Mr. Stefansson, at his request, a copy of the Blue Book, and on 3 June 1920 the Librarian wrote: "On examining the Blue Book I find it does contain a fairly large-scale map, dated 1853, of McClure's routes. I failed to find it in our own copy, as it had been bound in at the end of a collected volume and not in its proper place in the Report. I am sorry to have given you incorrect information when I wrote before [in a letter of May 29]. This map is evidently the original source copied by Arrowsmith." We are therefore responsible for having misled Mr. Stefansson for a few days; but it is unfortunate that he and Mr. McDiarmid should have overlooked our almost immediate correction of the mistake.

Relative Accuracy of the Admiralty Chart.

The coastline of Banks island as determined by Stefansson has been inserted on the chart cutting D already referred to. It will be noted that there is between his longitudes and Court's, a progressive discrepancy from Cape Kellett to Cape McClure, or, in other words, increasing with the run of the *Investigator*. This may be due to an erroneous chronometer-rate in either survey, or to the *Investigator* having been unable to get good sights for longitude, and hence been compelled to depend on dead reckoning.*

The statement "... There are several islands along the coast although only one, 'Terror island,' is shown on McClure's chart" is obviously wrong. On the Admiralty chart, as will be seen from the cutting, there are, and always

* In 'The Friendly Arctic,' p. 361, Mr. Stefansson remarks "... Thinking that Mr. McClure's winter quarters had been correctly located, partly because we knew one of the men on his staff bore the title of Astronomer, we were particular to get good observations. ..." McClure had no official astronomer on board. Mr. Stefansson is probably confusing him with Parry.

have been, shown several islands including, in addition to Terror island, Norway I., Robilliard I., and the Gore Is.

The statement ". . . On the map the coast is undulating, without deep bays or harbours; on the real land there are many deep bays and many harbours . . ." does not agree either with the Admiralty chart or with Stefansson's own charting. Court's chart shows four deep bays: Burnett Bay, another close northward of it, one south of Cape McClure and Mercy Bay. Stefansson's also shows four: one on the west coast in lat. 73° N., Burnett bay, one close westward of Mercy bay, and Mercy bay itself. The bays near Cape Giffard and Midlane Point are common to both charts, Stefansson's charting being somewhat larger in the former case, and smaller in the latter. Court's coastline is fully as indented as Stefansson's; in fact the latter is the more "undulating" of the two, although allowance must of course be made for the fact that it is enlarged, on the chart cutting, from a much smaller chart.

When the circumstances of Court's survey are remembered, the most striking point about the two chartings is not their discrepancies in detail, but their close agreement in general. McClure took a slow-sailing, deep-laden sailing ship, in the face of terrific ice and weather conditions, and at imminent risk of total loss, around a precipitous and iron-bound coast along a track of which only the southern half has ever been traversed again, and then by a steam vessel. That in such circumstances and under such a heavy and incessant strain upon all hands as mere navigation in such conditions implied, any kind of a survey should have been accomplished at all, is a remarkable achievement; it becomes far more remarkable when one finds, from a shore survey, made under conditions of comparative leisure and comfort sixty years later, that so little fundamental amendment is required.

Conclusion.

Summarizing the foregoing notes on the various points raised in Mr. White's letter, it may be said that two of them—the fact that the southern extremity of Stefansson's Lougheed island was sighted in 1853 by Richards, and the inaccuracies in Stefansson's account of the Admiralty charting of Banks island—appear to be borne out by the weight of available evidence. The remaining contentions, that McClintock sighted and charted Brock island, and that Sherard Osborn sighted Edmund Walker and Borden islands, do not appear warranted by the facts.

Looking at the whole question in a general way, it may safely be asserted that previous to Stefansson's expedition geographers in general had no suspicion whatever that within the region between Prince Patrick island and Ellef Ringnes Land there existed two such extensive islands as Brock and Borden islands, and that although a land-mass of indefinite outline was charted in the position of the Findlay group, this was based upon insufficient real information, and most of this information was incorrectly interpreted.

The two letters printed above and the Memorandum which follows them were put into type, and proofs sent to Mr. White, Mr. McDiarmid, and Mr. Stefansson, for their comments. We have received in response a large mass of letters, notes, and copies of correspondence between the parties. It is not possible to print them in full: but the following is believed to be a fair summary.

IV. MR. WHITE'S COMMENTS ON III

Mr. White deplores the "sub-acid tone" of the "so-called Memorandum." He contends that "Richards' journal is of little value except that it proves that the actual work of surveying was carried on by Osborn. . . . That Richards took unjustifiable liberties with Osborn's surveys. . . . That what Osborn calls the 'distant land' on 28 April and the 'new Island' bearing N. 21° W. and N. 37° W. is Findlay Island, and not the land 'looming in the N.W.'" He notes what seems to be a fair point, that Osborn's description of "Findlay Land" and his sketch of it are more detailed and precise than we should gather from Richards' chart, where the island is marked indefinitely as "loom of land."

V. MR. McDIARMID'S COMMENTS ON III

Mr. McDiarmid accepts the Memorandum as "a very fair, impartial, and painstaking summary." In regard to Ireland's Eye he quotes from Stefansson's diary of 17 June 1915: "Clearly those north of the second large island of the Polynia group run more north of east than the map shows, or else there are two chains of which we see only the westerly." Of the Findlay group he says: "It was the intention to keep the name Findlay and apply it to one of the large islands, but the Canadian Geographic Board decided to give the name to the whole group, and to accept the names shown on the map for the separate islands." In regard to the west coast of Banks Island he says: "The west coast of Banks Island as far south as the south side of Storkerson Bay was mapped from a survey made of the coast by one of the Stefansson party, but from that point to Cape Kellett there is not sufficient information to warrant any marked changes in the existing outline shown on the chart No. 2118. Mr. Stefansson in his 'Friendly Arctic' tells of large bays, etc. These doubtless exist, but the loss of Castel's observations made accurate mapping impossible below the point mentioned."

VI. MR. STEFANSSON'S COMMENTS

Mr. Stefansson was not anxious to take any part in the controversy, but sent various suggestions for the consideration of the author of the Memorandum, with the hope that some parts of it might be thus rendered unnecessary. It has seemed best, however, to print III in the form originally circulated, and to summarize Mr. Stefansson's replies thus: He remarks first that the criticism of the Banks Island chart on p. 261 of the 'Friendly Arctic' applies to the west coast only, between Norway Island and Cape Kellett, as is evident from p. 260. He then refers to the loss of Castel's survey, so that while every member of the Expedition who traversed that coast knows that it is deeply embayed, only conspicuous features like Storkerson Bay have been inserted. Mr. Stefansson acknowledges the receipt of the second letter from the Society, quickly correcting the first, and regrets that it was overlooked.

In regard to Ireland's Eye he remarks that in chap. xxii. of the 'Friendly Arctic' he mentions that they saw several islands and reefs lying between Prince Patrick and Bovet Island, in addition to verifying those charted by McClintock.

"We saw from Brock Island a small island in the direction of Prince Patrick Island which we said to each other at the time must be Ireland's Eye. We saw this island from several different vantage points on Brock Island in 1915 and also on our second visit the fall of 1916. We assumed it to be Ireland's

Eye, not because the charted position fitted exactly, but rather because all the other bits of land visible above the sea ice were gravel ridges of the nature described by McClintock for those he actually visited, while the one island had a level skyline and was therefore presumably grass-covered. When we argued this way we were assuming from the symbolism of the chart (which we have wrongly interpreted) that Ireland's Eye was an island seen but not visited by McClintock."

Mr. Stefansson considers that the following sentence on Patterson Island in the Memorandum should be omitted: "Until the position charted by Richards is further explored (Stefansson did not do this) there appears to be no reason why it should not be retained on the charts in its original position, and shown as what it undoubtedly is, a small detached island." His reasons are as follows: "At two different times I spent several hours in clear weather on the top of Edmund Walker Island some 600 or 800 feet above sea-level and studied with the glasses the skyline in every direction. To the south and south-east Bathurst Island and Helen Island were plainly visible—not a loom or mirage, but the steady land with clear definition of details. Had there been between me and Helen Island or between me and Bathurst Island a lump of earth (this was summer when all land was entirely free of snow) as big as a small cottage, I should have seen it plainly with my field glasses, and probably with the naked eye. It is unthinkable, therefore, that there can be any land between the Findlay group (as named by the Canadian Geographic Board and mapped by Mr. McDairmid) and Bathurst island, or between that group and Helen Island."

We understand that the compilation of the detailed maps of Mr. Stefansson's expedition by the Geodetic Survey of Canada is completed, but that publication is delayed. Mr. White's letter is symptomatic of a certain local criticism of Mr. Stefansson. Since we published Mr. McDiarmid's paper in the *Geographical Journal* we could not ignore Mr. White's criticism of that paper. Having subjected the matter to an impartial investigation to the best of our ability, and given all sides full opportunity for discussion, we shall not willingly return to the subject.

THE MOUNT EVEREST EXPEDITION

THE Mount Everest Expedition has had this year two misfortunes. Captain Morris had to go into hospital for an operation to his heel instead of going again as transport officer with the Expedition; and General Bruce went down suddenly with acute malaria two days after leaving Phari. The first misfortune was not so unexpected, for Captain Morris had some trouble with his heel last year when climbing with General Bruce in Switzerland. But it was a great loss to the Expedition. In the first despatch from Darjeeling the General said that Major Morshead was anxious to replace him as transport officer. But it proved that he could not get leave; and indeed, after his severe injury by

frostbite in 1922 he was not really fit to go, though he made a last gallant attempt to pretend the contrary.

The second misfortune was altogether unexpected. General Bruce had been very well all through the arduous work of fitting out the Expedition at Darjeeling. He had been subjected to the full air-force tests for high altitudes by Major Hingston, and at Phari had come through the renewed tests better than some of his younger companions. Two days later, at Tuna, he was suddenly attacked with the acute malaria from which he had suffered at Bannu in 1919; he lost weight rapidly, became very weak, and was carried back to Yatung in a stretcher provided by the medical officer at Gyantse. After a few days' recuperation he was taken back to Gangtok by Major Hingston, and thence went on to Darjeeling, while the medical officer went off by Lachen to rejoin the Expedition.

All friends of the Expedition will sympathize with General Bruce and his great disappointment. After he had worked so hard and kept so fit it was bad luck that some slight chill in camp gave opportunity to the germs of Bannu malaria that suddenly knocked him out. There seems scarcely any hope that he will be able to rejoin the Expedition, though he reports himself as fit again at Darjeeling. He will, we hope, be content to remember that he performed this year two indispensable services—he chose the porter corps and camp servants from the numbers of hillmen that flocked into Darjeeling again to serve under him; and he got the Expedition safe past the danger point at Phari, where the bargaining for transport is critical, and the standard expenditure is set for the rest of the visit. Whatever success comes to the climbers will be built upon General Bruce's foundations, and we are all sorry that he has missed the pleasure of directing the last stages.

His command has passed into the most capable hands of Colonel Norton, who has brought the whole party without further casualties or difficulty to the old base camp in the Rongbuk valley two days earlier than in 1922. They had better weather on the passes and across the plateau; but winter was still fairly established in the upper Rongbuk, and they could not usefully have come earlier still. All members of the party, European and Himalayan, are reported fit and well. They reckoned that further time had been saved by the method of packing the stores this year, so that if the old reconnaissance of the East Rongbuk glacier is still valid, it should be possible to establish the higher camps several days in advance of the 1922 time-table, which is as follows:—

	1922.	1924.
Arrive Base Camp	May 1	April 29
Camp III. established	May 8	——
Camp IV. established on Chang La ...	May 17	——
First high climb	May 21	——

In 1922 General Bruce spent nearly his whole time at the Base Camp,

and was more than fully occupied then with transport and labour difficulties. This year it is likely that conditions may be easier at the base, and we anticipate that Colonel Norton will leave Captain Bruce or Mr. Shebbeare in charge there and transfer the headquarters to Camp III., at least for a while. The first climb can hardly take place before about May 17 at the earliest; the last not later than about June 10, unless the monsoon is delayed. There are perhaps three weeks in which success may be won whenever there are three consecutive fine days, and it is a good deal more than possible that oxygen and non-oxygen parties may both have made the ascent by the time this note (written May 19) is published. The despatch of April 29 was published on May 17, nineteen days from the base camp. It looks as if we may expect some news of the climbing any time after June 7.

THE TELEGRAPH TO LHASA

W. H. King, Assistant Engineer, Indian Telegraph Department

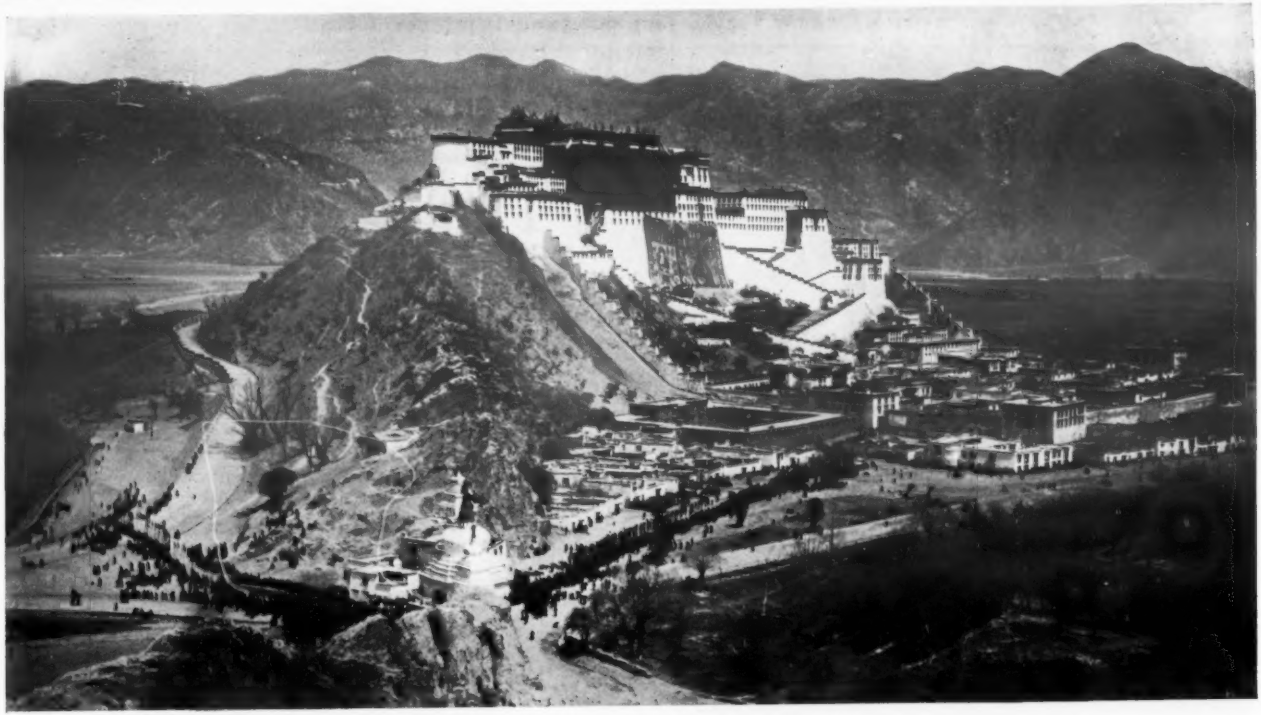
THE idea of extending the line from Gyantse 144 miles to Lhasa was conceived by the Tibetan Government. They purchased the wire, brackets, and insulators from us, and supplied their own wooden poles and labour in addition to paying the wages of the twenty-two head coolies recruited by us. The Indian Government lent them the services of one deputy assistant engineer, a supervisor, and the four linemen. The poles of the Lhasa line are of wood of a light type, but their transport was a stupendous task. In many cases they had to be carried by manual labour 60 miles to the site of the line, one village taking them on to the next. I saw teams of six villagers, husband and wife, two sons and two daughters, harnessed to three poles and carrying them along. The Tibetans distributed the material along the line, and I was given a further supply of eighty coolies for the work. All the transport and labour worked gratis for the Tibetan Government. The estimate allowed three months for the work, but thanks to the very sensible specification of the material prepared by Mr. J. Fairlay, Divisional Engineer Telegraphs, after his survey in 1921, the success of Col. Bailey in getting the Tibetan Government to realize the need for quick action if they wished to keep within the estimated expenditure, and the splendid arrangements made by the Tibetan authorities, the line was completed in five weeks at an average rate of 4 miles per day. For these arrangements the Tibetan Trade Agent, a Lama of high degree at Gyantse, is primarily responsible. Four Tibetan gentlemen were sent with us for training as linemen, but as their social status was too high for the class of work, four men of the peasant class were trained

instead. Of the four gentlemen two, named Keesoo and Jorkay, were recommended to the Tibetan Government for employment as supervisors.

In order to prevent trouble with the Tibetans, to serve as a mentor for Tibetan etiquette and customs, and to act as interpreter, a young Tibetan aristocrat named Kyipook was sent along with us. He is one of the four young Tibetan gentlemen who were sent to Rugby in 1914 for education. On his return he was given a further training in civil engineering in Roorkee Engineering College, and then a year's training in telegraphy at Kalimpong. He proved very useful, and, thanks to his genial and kindly nature, everything went off without a single dispute. He has been selected to be the Director of the Telegraph and Telephone in Tibet.

I was told that the Tibetan labourer was slow, stupid, and indolent, but I found him to be the best worker I have yet seen in my experience of labour in many parts of India and East Africa. In lieu of taxation Tibetans perform Government work without pay. For the telegraph line, therefore, the labour and transport had to be changed at every district. A large pile of stones on each side of the road marks the end of one and the beginning of another district. Under no pretext will a villager from one district work beyond his boundary. In spite of the privations which hard work under such trying conditions caused, I always found them happy and contented. The Tibetan labourer is quick to grasp what is required to be done, and quick to perform it. He is very submissive, cheerful, and polite. His position in life is very humble; he must pay very deferential respect to his superiors, and when he approaches any of them take off his cap and hold it in both hands, bow his body forward, and loll his tongue out and remain in that posture until dismissed. He, however, possesses a lease of land, flocks, and herds which yield him and his family ample supplies; so he goes through life with a full stomach, and is perfectly contented.

The completion of the line was looked upon as a great event by the inhabitants of Lhasa, and on the day on which the line was taken through the city the streets were crowded with people. The line was very favourably received all round except by those along whose fields it went; and the reason for this exception is that the owners thought they would be held responsible in case the posts broke. The Lamas gave us a friendly reception throughout, and in one case where the line had to be taken through the grounds of a monastery, the Lamas in occupation were very helpful. When within 3 miles of Lhasa the Tibetan Council sent a messenger asking me to avoid the main road for the last 3 miles and to enter Lhasa from across country, the reason assigned being that the Lamas from the two big monasteries of Drepon and Sera pass frequently along the road, and the younger men might be tempted to smash the insulators, just as they used to do with a Chinese line years ago. But the general effect of the line on all classes was one of pride that Tibet had



THE POTALA, LHASA: AND PROCESSION OF LAMAS.

Seated—MR. W. H. KING; TSARONG SHAPÉ, COMMANDER-IN-CHIEF; NGAPPA SHAPÉ, CIVIL MEMBER OF COUNCIL; PARKHANG SHAPÉ, LAMA MEMBER OF COUNCIL
Standing—MR. KYIPOOK, TIBETAN DIRECTOR OF TELEGRAPHS; MR. W. P. ROSEMEYER

telegraph and telephone lines at last, and that they would no longer be the laughing-stock of Chinese and Japanese merchants and pilgrims.

The Potala and the large Buddhist temple now have telephones in them connecting the offices of the Prime Minister and Council Chamber with the Dalai Lama's summer palace. We were allowed to wander freely over these buildings, and Rosemeyer was given permission to photograph anything he liked except one image in the Cathedral. The majority of the shopkeepers are Nepalese, and there are also a few Ladakhi Muhammedans. The latter, I was told, are noted for their sobriety and good behaviour. I found them good fellows, but in the habit of putting on prices tremendously. Their leader Khan Saheb Faizulla was very helpful in arranging our financial affairs by getting his agent to draw our money in Gyantse and paying us in Lhasa, and also in getting his brethren to sell at reasonable prices.

The first Telegraph Master of Lhasa is Mr. Sonam Tsering, sent on deputation from the Indian Postal Department. He is Tibetan by birth but a Christian by religion, educated in Kalimpong and Darjeeling. Except for him the line is worked by Tibetans. Two Lamas are undergoing training in telegraphy in Kalimpong, and on their passing out will relieve the Indian Telegraph Master. The system will then be managed and worked entirely by the Tibetan Government. The telegraph system is used almost entirely by the Nepalese and Ladakhi Muhammedans and a few Tibetan merchants, the majority of Tibetans not having any use for it. But the telephone is very popular with the Tibetans, and whenever opportunity affords the chance of a chat with a friend or relation the other side they avail themselves of it eagerly, and it is difficult to get them to end the conversation once they start. The post and telegraph system in Tibet is managed by joint Postmasters-General, one a Lama and the other a civilian. The postal system is fairly good and letters are regular. They have a system of runners worked on our Indian system, and I have often seen these men running their beat of 5 miles with the short spear and bells of the Indian runner.

The Buddhist priests of Tibet are called Lamas, and it is the invariable custom that at least one male and one female from every family be dedicated to the life of a Lama. The Prime Minister is an old gentleman of over sixty years of age, of august bearing and charming manners. He is a Tibetan of the old school, and a firm believer in the greatness of Tibet and the goodness of the Buddhist religion, with an unwavering belief in its gods and dragons. It was easy to interest this charming nobleman, as he possessed intelligence of a high order, and had visited India with the Dalai Lama and had seen a good deal of our modern inventions. His courteous manner displayed itself in a delicate style of flattery. When talking about the telegraph line he said, "Your department has erected a monument in Tibet which can be seen for miles and appreciated by all. Thousands of pilgrims will come from

Seated—MR. W. H. KING; TSARONG SHAPE, COMMANDER-IN-CHIEF; NGAPPA SHAPE, CIVIL MEMBER OF COUNCIL; SHAPE, LAMA MEMBER OF COUNCIL
Standing—MR. LAMPSON, DIRECTOR OF TELEGRAPHS; MR. W. P. ROSEMEYER

China, Japan, and Manchuria, and will realize that at last Lhasa possesses telegraphs and telephones, and on their return home will spread the news and the name of the builder all over the East." Talking in this connection, he said that there was a waterfall 4 miles out of Lhasa which offered the means for working a large hydro-electric scheme for lighting Lhasa. At the same time he said a young Tibetan was learning electrical engineering in London, and on his return a scheme for lighting Lhasa was to be undertaken. It was his great ambition, he said, that God would spare him long enough to see the streets of Lhasa lighted with electricity.

Tsarong Shapé, the Commander-in-Chief, is the Dalai Lama's favourite councillor and his constant companion. He has a short, tough, wiry figure, and looks every inch a soldier and a leader. He possesses intelligence of a high order and a happy, vivacious disposition. He is very easy to interest, as he loves to listen to military, police, and diplomatic exploits, and takes a keen interest in everything Western, and is quick to understand its use. I found his house full of engineering instruments of all descriptions. He is an expert photographer and takes and develops his own plates. His daughter is being educated in a girls' school in Darjeeling. He accompanied the Dalai Lama during his journey through China and Manchuria in 1904, and also during his journey through India in 1911. When I was leaving Lhasa he asked me not to be anxious about the future of the telephones in Lhasa, as he would repair them himself. From what I saw him doing there, he is capable of carrying out his promise.

I came in occasional contact with a few military officers. Their uniforms are entirely British, and all of them cut smart figures in them. Surkong Depon (Colonel) is the mint-master of Lhasa, and an enthusiastic progressive like his master the Commander-in-Chief. The modern Tibetan army is well trained and smart. They have a fife-and-drum band, bagpipes, and bugles. These can compare with some of the best Indian regiments. It is quite inspiring to see the battalions fix bayonets, present arms to His Holiness to the tune of "God save the King," which the Tibetans have adopted as their national anthem, and march away with gorgeous yellow satin banners flying to the tune of "The girl I left behind me."

The Dalai Lama took a keen interest in the fixing of his telephone, and pointed out the exact position where he would like it. A large battery was needed as the bell was of the battery-ringing type. He sent for his carpenter and ordered a box for the cells from his own design. The carpenter delivered the box ready with partitions in 20 minutes. We had no dry cells and had to prepare a battery by putting perished dry cells into a solution of sal-ammoniac. We had no jars, and His Holiness promptly satisfied this want with highly glazed Japanese flower-pots, which he cheerfully sacrificed. To enable him to use one telephone

on two circuits at will, I designed a plug-switch which the court blacksmith promptly made up from brass. The plugs needed an insulating handle, and His Holiness ordered his Manchurian ivory-carvers to make one of ivory. He was quick to grasp the idea of the switch and to understand how it worked, and he used to watch the preparation of batteries and adjustment of bells with great interest. His Holiness's hobby is gardening. His summer palace grounds are laid out on the English system, and are full of flowers and turf lawns. When I bade him farewell, I told him that I would send him the best magneto telephone on the market; his reply was that I may do so, but what he would like above all was some good flower seeds. I promised to send him some which were obtained from flowers grown in the Kashmir valley, as these would be more suitable to the Lhasa soil. The Dalai Lama talks in a low voice, and most people would think that it would never penetrate a long-distance line, but it surprised me to find that his voice penetrated often when others failed to reach. I listened-in on the line once on my return journey, and I was surprised at the rich timbre of his voice. His personal interest in his own servants was great. When I was leaving Lhasa for India, he asked me if I could take Rs.20 for him to two Tibetan youths who were learning gardening in the Residency at Gangtok, and also to deliver a message to them. He is a keen photographer and takes good photographs. I thought I was taking him a very rare present in an electric call-bell with bell-push, but I found that he had just six of these and about ten telephones, with large quantities of insulated wire.

On my return to Calcutta I was sent back to Rawalpindi and then up the Tochi valley in Waziristan on the North-West Frontier for a month. The difference between the two frontiers there is no mistaking, for where I could travel even at night without an escort in Tibet my work in the Tochi was restricted to the hours of 8 a.m. to 3 p.m., after which the road was closed and every one must be within barbed wire or remain out at their own risk. Even in the working hours my party had to be escorted, and we were a continual source of anxiety to the Officer Commanding Signals. Walking to and fro amongst the Waziri travellers on the road during the day is like walking amongst tame lions.

INTERNATIONAL GEODESY

Bulletin Géodésique No. 2 (Avril 1923), Conseil International de Recherches, Union Géodésique et Géophysique Internationale, section de Géodésie. Toulouse: Édouard Privat, [1923]. 10 × 6½, pp. 173. 4 *Diagrams and a Map. No price.*

Prime indagini sperimentali relative al Collegamento geodetico della Sardegna alla Liguria.— Antonio Loperfido. *L'Universo, Gennaio,*

1924. Firenze: Istituto Geografico Militare, [1924]. Pp. 1–46. 9 *Illustrations and* 2 *Diagrams.*

THE second number of the *Bulletin géodésique* contains the report of the first general meeting of the *Section de Géodésie* of the *Union géodésique et géophysique internationale*, which took place at Rome in May 1922, the first number being the brochure distributed to the delegates at the time of that meeting. Some longer papers, and in particular the several national reports of recent geodetic work, have been printed in a larger publication under the title of 'Travaux de la Section de Géodésie de l'Union géodésique et géophysique internationale.'

As might be expected at the first meeting of the Union, which has been established to take the place of the pre-war "Association géodésique internationale," a considerable part of the time was necessarily occupied with questions of organization.

In addition to the hearing and discussion of a number of papers, however, the meeting passed five important recommendations in which it defined the directions in which it considered that the various states represented could most readily work together to further the immediate progress of geodesy, and also passed four resolutions in which the work which is to be undertaken by the Union itself is laid down.

The meeting strongly recommended that immediate steps be taken by the French and Belgian Governments to complete the junction of their two national triangulations. It also urged that the junction of the French and Italian triangulations in Savoy, interrupted by the war, should be completed as soon as possible. Lieut.-Col. Georges Perrier's communication on this subject shows how the intended junction along the frontier between Mont Blanc and Mont Cenis has been delayed and the necessary work greatly increased by the loss of some of the important triangulation points; while near the coast of the Mediterranean, although all needful observations have been made, definitive results must await the complete adjustment of the geodetic chains known as the Meridian of Lyons and the Parallel of Avignon.

The third recommendation urged the junction of the triangulations of Sardinia and Liguria through Corsica, which project was the subject of two papers by General Nicola Vacchelli and Prof. Antonio Loperfido respectively. These papers showed that the junction could be effected by the occupation of one additional station only, on Monte Artica in Corsica, and that none of the rays to be employed would be longer than 230 kilometres or would pass less than 240 metres above sea-level. The section expressed the hope that France would allow Italian observers to occupy Monte Artica, or would herself carry out the necessary observations there; while Prof. Loperfido stated that the "Istituto geografico militare italiano" would commence the necessary experimental work at once.

The results of the initiation of this survey are set forth in the Professor's article in *L'Universo* for January 1924, entitled "Prime indagini sperimentali relative al collegamento geodetico della Sardegna alla Liguaria." In this article he describes the desolate island of Gorgona, off the coast of Tuscany, its conditions and the detailed work done there in the summer of 1923 by a party from the Italian Military Institute of Geography under his leadership. The main object of the expedition was to put to a practical test, under similar conditions to the Corsican junction, the large Faini projecteur used with oxyacetylene light. The ray from Monte Settepani (on the Liguarian coast) to Gorgona Island, some 160 kilometres in length, was

selected as a test, and on the night of August 25 the observers at Gorgona Semaphore Station were able to see the light from Monte Settepani quite plainly with the naked eye and to secure the azimuth of Monte Settepani.

Prof. Loperfido's party also took observations for latitude and made use of the romantic old castle of Torre Vecchia for pendulum observations which they later repeated at Florence, and so obtained an absolute value for gravity at Gorgona.

The fourth recommendation passed by the meeting urged the governments of France, Italy, and Egypt, which last had just been admitted as a member of the Union, to study methods for joining the Cape-to-Cairo Arc to the European network along the North African coast. Lieut.-Col. Georges Perrier explained that a triangulation of the first order, known as the Meridian of Gabes, already exists in Tunis, and that, before the French occupation, Tunis had been already joined to Sicily by Italian engineers. He hoped that when the Libyan coast should be completely occupied and pacified nothing would prevent the Italians from establishing a triangulation of high precision along that coast. It remained for Egypt to establish a like triangulation between the Tripoli frontier and Cairo, the northern end of the chain of the 30th meridian.

The last recommendation dealt with the need of completing an arc of the meridian from the Arctic Ocean to the Mediterranean and of prolonging this arc into Africa. This work will involve the co-operation of the governments of Norway, Sweden, Poland, Czecho-Slovakia, Yugo-Slavia, Italy, and Greece to effect the junctions of their existing triangulation, while the Egyptian Government is desired to prolong its geodetic triangulation to its western frontier. The method of obtaining a junction between Europe and Africa, presumably through the island of Crete, still remains to be studied.

Among the resolutions passed by the meeting one arranged for the continuance of the pre-war work of the "Service international des Latitudes" in respect of the study of the variation of latitudes at the three stations of Carloforte in Italy, Misuawa in Japan, and Ukiah in the United States, which work is to be supervised by a mixed commission of astronomers and geodesists; another resolution decided that the project of world-wide longitudes proposed by General Ferrié should be carried out in conjunction with the "Union astronomique," while the last resolution provided for the study of the questions of an international ellipsoid of reference, of the most appropriate systems of projection for large areas, and of standardized methods for the observation and computation of geodetic triangulation, by the Executive Committee who are to report on these subjects to the next General Meeting.

The Bulletin also contains a number of short notes presented to the meeting on subjects which include isostasy, gravity observations, electrical recording of pendulum oscillations, atmospheric refraction, and an apparatus to determine the personal equation in observations with the prismatic astrolabe.

From this short summary of the report it will be seen that the "Section de Géodésie" is to be congratulated on a six days' meeting very full of interest and which should be most beneficial in producing future international co-operation for the furtherance of geodesy in all its branches. G. S. L. C.

REVIEWS

EUROPE

London on the Thames.— H. Ormsby. London: Sifton, Praed & Co., Ltd. 1924. 8¼ × 5¼, pp. xiv. + 189. *Sketch-maps and Illustrations.* 8*s.* 6*d. net.*

IN her preface Mrs. Ormsby feels it necessary to excuse the publication of yet another book on London. Her plea is that previously the "natural conditions governing the birth and growth" of that great city have not been treated as fully as they require. The book's title emphasizes the governing factor in that growth—the Thames. Though the wider influences which have contributed to London's commercial supremacy are dealt with at the outset, Mrs. Ormsby's main purpose is to show why the city which was almost bound to grow up on the lower Thames should have been founded exactly when and where it was. From a study of the geology of the lower Thames basin, and the probable condition of the countryside resulting from it, she argues against the theory of an original Celtic foundation. The flood plain of the Thames, and the extent of the "Middlesex forest" would confine settlements to the line of the Chiltern chalk, which accounts for the early importance of Verulam. The actual site of London was determined by its proximity to the best Thames crossing for the Roman Watling Street running from Dover to Verulam. This was at first probably near Westminster. By reconstructing the topography of "London before the houses," Mrs. Ormsby makes it clear how the advantages of a site further east, where the gravel-capped clay spurs of the northern plateau run down to the river, would soon prevail over those of Westminster. On two of these spurs, between which flowed the Walbrook, the Roman city grew up. The topography, with its consequences for the site of the city walls, the boundaries of the wards, the water-supply, the sewers, and the state of the surrounding country, moulded London's domestic history throughout the Middle Ages and later. In the river-side creeks, too, there developed the rudimentary stages of the great port of London. Mrs. Ormsby writes with such enthusiasm, and illustrates her points so clearly with sketch-maps and diagrams that one almost regrets that in the course of time human ingenuity triumphed over, and almost obliterated, London's topographical characteristics, and so set a limit to her book.

The Hampshire Gate.— H. G. Dent. London: Ernest Benn, Ltd. 1924. 8 × 5, pp. 179. *Illustrations and Sketch-maps.* 3*s.* 6*d. net.*

The aim of this monograph is to illustrate the interaction of geographical and historical factors in one particular region of England—the Itchen basin. For this purpose the choice of the "Hampshire gate" was a good one, for, throughout, the dependence of local history upon the route cut by the Itchen through the southern folds of the chalk uplands of northern Hampshire and across the broad shallow plain of sand and clay to the English Channel can be clearly traced. This history centres mainly around two towns, Southampton and Winchester. The double high tide up the Solent is a well-known factor in the growth of Southampton as a port, but it is also noted here how the conjunction of the Isle of Wight and the Cotentin peninsula on the French side greatly reduces the Channel crossing, permitting it to rival the south-east Kent passages. Thus, so long as English interests lay mainly in southern England and north-west France, Winchester remained the administrative centre of England. As the economic centre shifted northwards, the importance of this area declined. Except during the

heyday of the wool industry, the products of this region for export have not been considerable, the chalk downlands being especially poor. Once again, therefore, outside factors have been exerted to restore its former prosperity; the advent of the railways, by linking it up with the North of England, if it has been unable to re-establish Winchester as the capital in place of London, has at least put Southampton once more among the great English ports. Mr. Dent's analysis of the factors contributing to this growth is clearly and interestingly written. Some repetition might perhaps have been saved if the story had been dealt with period by period, rather than by giving the history, the economic growth, and the development of communications at length in self-contained chapters. A sketch-map of the area on a larger scale than that contained in the book would have been useful.

Queer Things about London.— Charles G. Harper. Illustrated by the author. London: Cecil Palmer. 1923. 7½ × 5, pp. 256. *7s. 6d. net.*

The "strange nooks and corners of the greatest city in the world," with which this book deals, seem to have been selected rather haphazardly. While, for example, the history of St. Paul's is given at length, the Tower is neglected. Mr. Harper, however, displays a considerable knowledge of out-of-the-way facts concerning London buildings and streets. His more entertaining chapters deal with objects generally unknown to ordinary citizens and neglected by most guide-books. Such are those which treat of "Old London lamp-posts" and "City vanes." His pages, though at times loosely written, are always interesting.

The National Library of Wales. Bibliotheca Celtica; a register of publications relating to Wales and the Celtic peoples and languages for the years 1914–18. Aberystwyth. 1923. 5½ × 6, pp. vi. + 452. *7s. 6d. net.*

An effort has been made to preserve for the National Library all such publications as deal with Wales and the War. The extent to which this has been done is difficult to estimate, as the entries are arranged mainly in one alphabetical series under authors. The sections devoted to institutions, societies, and newspapers should prove of much assistance to local historians. A considerable amount of Irish and Breton literature is also represented, and in some cases the scope of the catalogue seems to have been interpreted rather widely.

ASIA

Strabo on the Troad: Book XIII., chapter I. Edited with Translation and Commentary by **Walter Leaf, Litt.D., Hon. D.Litt.** Cambridge University Press. 1923. 9 × 6, pp. xlviii. + 352. *Map and Illustrations.* *25s. net.*

Among the undertakings interrupted by the late war was the preparation of a detailed commentary, in which various scholars were to co-operate, on the three books of Strabo dealing with Asia Minor. The present volume is a fragment of the whole so designed, the only portion which it has yet been possible to complete. It comprises the first chapter of the thirteenth book, *i.e.* the portion relating to the Troad, edited with a translation and commentary by Dr. Leaf, who was the originator of the scheme and would have superintended its execution had circumstances allowed.

Strabo is an author who makes large demands on a commentator. And his account of the Troad is for various reasons one of the least satisfactory portions of his work. It is pretty clear that he never visited the district, and that he followed, sometimes with far from laudable docility and sometimes (as Dr. Leaf well shows) with still less laudable misunderstanding, Demetrius

of Scepsis, a geographer whose careful accuracy in matters of fact is not infrequently neutralized by perverse theories born of local patriotism ; so that Strabo's work is vitiated by some lamentable blunders. The first place, moreover, in Strabo's own interest was given to the elucidation of Homeric geography, and in consequence a disproportionate amount of his lengthy chapter is devoted to quasi-literary discussions. This fact is duly noted by Dr. Leaf, who refuses the double temptation to do likewise. But perhaps there was no need for self-denial. Dr. Leaf is entirely equal to his task, and writes with unassuming and various learning on topics ranging from history and geography in the narrower sense to bird-lore and the present-day habits of local steamers. Though likely to be used chiefly by the specialist or the traveller, the book will doubtless be widely welcomed as a standard authority. Style and arrangement are notably lucid, and full references are appended to the longer notes. There are also numerous excellent photographs.

Our knowledge of the ancient geography of the Troad is naturally far more advanced than that of many parts of Asia Minor. Yet much remains to be discovered. Many sites even of the classical period are still quite uncertain ; and there are districts that may never have been visited in modern times by Europeans. Dr. Leaf is thus able to make important corrections and contributions to the subject, in addition to the great service he has rendered to scholarship by his collection and ordered exposition of so much material, which may in turn form a starting-point for further development in manifold directions. It is to be hoped that it may be found possible at no distant date to carry out the original design. A complete commentary on this scale, even if confined to Asia Minor, would be a great achievement for English scholarship, and a contribution of extreme value to that detailed study of ancient topography which already, in the hands of Sir William Ramsay and his British collaborators and followers, has made a conspicuous addition to our knowledge of the Græco-Roman world. E. W. V. C.

The Nations of To-day.— Edited by **John Buchan. Japan. Joseph H. Longford, D.Litt.** London: Hodder & Stoughton. 1923. 9 × 6, pp. 325. *Map.* 15*s. net.*

The publication of a fresh work on Japan by Prof. Longford makes an important addition to the growing literature on that well-known but, too frequently, little-understood land. Emeritus Professor of Japanese at King's College, London University, Dr. Longford has already published several standard works on Japan, and one on Korea, the result of thirty-three years' experience of life and work in H.B.M.'s Consular Service in the Far East. He is abundantly qualified for his task, for he has travelled throughout Japan from the Kurile Islands in the north to Formosa in the south, having served at practically all the chief consulates in those regions.

The present volume begins with an excellent *résumé* of the leading geographical features of the country and of the ethnology of the people, then taking us on through a sketch of the legendary epoch to the dawn of actual history. The last-named section is of great importance, since it gives a clear and concise account of the greatest change Japan has ever known—that wrought by the coming of Buddhism from China by way of Korea in the sixth century A.D. Prof. Longford shows it to have been not only, apart from Christianity, the "greatest religious revolution known to history," but one which entirely changed the character of Japanese civilization—domestic, social, and political. No department of life was left untouched and few were not entirely transformed. Both Chinese and Korean teachers of literature, astronomy,

geography, medicine, painting, sculpture, architecture, and pottery were encouraged to settle in Japan, and were rewarded with brevets of high rank which entitled them to take their places among the native aristocracy. Descendants of Korean potters are to be found in the island of Kyushu at the present time, and one of the most famous of the former Daimyō of that island can trace his descent from Chinese ancestors.

A considerable portion of the book is occupied with accounts of the various epochs of Japanese history which afford a valuable insight into the characteristic features of Japanese mentality, and of the varied and stirring events that have combined to produce a state of society quite unlike that of any other people.

In the Heian epoch, which lasted from 806 till 1156, we find the culture of Japan rising to its highest level. Prof. Longford observes that "it may well be doubted whether in the whole of the wide world there was a contemporaneous Court so full of the most æsthetic culture as was that of Japan in the Nara and Heian epochs, while the fighting men of the Empire were . . . as stalwart and brave as the dalliants of the Court were accomplished and refined." Nine hundred years ago the court lady Sei Shonagon recorded in her diary just what might easily have come from the lips of a lady "in society in England to-day." "She thought it detestable to find a hair on her pen when writing—to have a dog which barked at a lover's coming—to have a lover who, when carefully hidden, falls asleep and snores—to be interrupted when telling a good story," and so forth. Chapter vii. gives an excellent account of the origin of feudalism and the rise of the Shogunate.

Early in the fifteenth century we find the King of Korea, Taijo, not only reorganizing his army, but driving off with heavy losses the Japanese pirates who for so long had terrorized the Korean coasts, and ultimately exterminating them on the sea.

In the chapter (xi.) on "Early European Intercourse" with Japan, we have an illuminating account of the arrival in the sixteenth century of the various visitors from the west—Portuguese and Spanish merchants, Jesuit missionaries, and, most mercenary of all traders, the "ignoble Dutch," who for the sake of gain "assisted the Japanese in their dreadful work of exterminating all who held the Christian faith, under the fear that its propaganda was but a cloak for political intrigue and European aggrandisement." No wonder that the Japanese, though glad to profit by their help, yet "despised the renegade traitors who had bartered their honour for commercial privileges."

The story of the "Restoration," fifty-six years ago, when the Shogunate was abolished and the Emperor came forth from his age-long seclusion, to rule as well as to reign; of the gradual constitutional reforms and industrial developments of the subsequent epoch, together with Japan's growing intercourse and conflict with Western powers—all is told with exceeding vigour, frankness, and skilful marshalling of facts. Not the least interesting are the concluding sections which bring up to date the circumstances and the peculiar conditions of Japanese labour problems in the present and the difficulties that lie ahead. Indeed, this volume is the most valuable work of its kind that has appeared in recent years. W. W.

Two Gentlemen of China.— Lady Hosie. With an Introduction by **Professor Soothill.** London: Seeley, Service & Co. 1924. $8\frac{1}{2} \times 5\frac{1}{2}$, pp. 316. *Illustrations.* 21*s. net.*

This is a book which has an interest both for those who know China intimately, and for those who know it not at all. Few of the former will fail

to learn something from Lady Hosie's intimate account of her sojourn in the home circle of two patrician families in China, while the latter may well find it an admirable corrective to the popular idea, which still persists, that the Chinese, besides being a race of superlative cunning, combine in their characters every known vice, without any compensating virtue. Lady Hosie shows them neither as angels nor as demons, but as human beings. She is qualified to do so, for she was born in China, speaks Chinese, and has been intimately connected with the country all her life, and she obtained her material at first hand. She was particularly fortunate in gaining the friendship of both Manchu and Chinese, for while Lo Ta Jen was a Manchu official of high rank, Kung Ta Jen was a Chinese, a great scholar and Chief Judge of a province. The dignity and wisdom of the elder members of both families were equalled only by the light-hearted and affectionate ways of the young people. The manner in which Li Cheng loved to tease his sisters, Flower and Small Six, the love of Gentle Calm for her baby, and the parents' problems of how best to hold "the delicately hung balance between wise discipline and sweet reasonableness in facing the enthusiasms and needs of growing youth, at the same time maintaining wise traditions": all these things make Lady Hosie's friends seem very human, and she shows how East and West touch each other in the common problems and affections of the home. Her book, although it does not profess to be a scientific contribution to anthropology, has, nevertheless, the value of a recorded experience which has befallen few Europeans, besides giving a delightful and eminently readable description of an unfamiliar phase of life.

The photographs are interesting, but would have been more so had they had some direct bearing on the text. O. R.

The Great River.— G. M. Fitkin. Shanghai: Kelly & Walsh, Ltd. 1922. 10 × 7, pp. v. + 153. *Illustrated.* 15*s.*

The great river of Miss Fitkin's book is the Yangtze Kiang, up which she journeyed in 1921. To attempt to describe at all fully and within moderate limits the vast region through which the river flows would be impossible, especially when, as in the present case, the writer's interests are wide, embracing history, politics, and economics. Thus Shanghai is warmly eulogized, the recent development of the railhead and port of Pukow is described, the decay of Kiukiang as a tea-exporting centre analysed, and the navigational problems of the Ichang gorges are set forth, to mention but a few of the subjects handled. To this narrative, which would otherwise be confused and fragmentary, the Yangtze itself gives unity; in every district the river is always the dominant factor. It is also interesting to notice the conflict of old and new throughout its course—Treaty ports, missions and self-government in schools, as at Anking, opposed to age-old agricultural and industrial methods, opium smuggling, brigandage and outlawry. But it must be remembered that the book is primarily the record of a journey, and as such treats these matters incidentally.

AFRICA

The Wanderings of an Elephant Hunter.— W. D. M. Bell London: 'Country Life,' Ltd. 1923. 10 × 7½, pp. 187. *Illustrations.* 21*s. net.*

Mr. Bell's ruling passion from an early age has been elephant hunting. His book contains therefore his experiences and opinions on the more technical side of that sport. To those who are unlikely to have to decide in practice between the merits of the brain and the body shots, the incidents of his

extensive African travels will be of greater interest. These are sometimes intimately connected with the sporting side, as, for example, when he relates how he sought, and sought successfully, the aid of a medicine man in reaching his quarry. A visit to the stronghold of one of the remaining native potentates, that unenlightened autocrat, Buba Gida, provides material for another entertaining chapter. One of Mr. Bell's longer journeys was the ascent of the Bahr Auk in the Central Sudan, which brought him through a veritable sportsman's paradise, teeming with hippopotamus, rhinoceros, lion, and elephant. In relating his adventures, the author's style is clear, straightforward, and amusing throughout. His book is illustrated with some interesting photographs.

Tut-ank-amen and other Essays.— **A. Weigall.** London: Thornton Butterworth. 1923. 9 × 6, pp. 288. *Illustrations.* 15*s. net.*

Of this series of sixteen essays only the first four refer to Tut-ank-amen and his tomb, at the opening of which the author was present, and of which he gives an illustration representing the gold-covered shrine within the sanctuary. The subject leads him however to a disquisition of considerable interest, coming from a former Inspector-General of Antiquities in Egypt, in which he discusses the relation of archæological excavators to the Egyptian Government, laying stress on the obligations of the former to the latter. It also suggests, under the title of "The Ancient Ghouls of Thebes," a realistic account of the robberies from the tombs in ancient times. Archæological interests are also considered in an essay on "The Flooding of Lower Nubia." In reply to many severe criticisms he shows that in the construction of the great dam at Aswan the utmost regard, consistent with the essential requirements of the scheme, was paid to the archæological treasures affected or endangered, and that, comparatively speaking, little serious damage was done. The remaining essays are chiefly concerned with the Eastern Desert, little visited and still imperfectly known, and it is in the relation of the author's experience here that the novelty of the book chiefly lies. He has felt the charm of the desert in no small degree, and never wearies of referring to it. Traversing it from the Nile to Qoseir on the Red Sea, he visited and describes the porphyry and other quarries, and the gold workings of ancient days, and particularly interesting is his account of the remains of the numerous Roman settlements. So much evidence of the penetration of Rome into this desert will be a revelation to many.

Regarding Egypt as the Gateway of the East, Mr. Weigall is very optimistic regarding its future. Freed from the misrule of the Turk, and having regained its national freedom, surrounded by friendly powers, the riches of the country, the fertility of its soil, and the industry of its people may well bring back to Egypt some at least of the greatness of the past. That past enjoyed a civilization which, if we interpret rightly the author's last essay on "The Meaning of Civilization," was little inferior to civilization as we know it to-day. There are a number of illustrations, including the mummies of Thutmose IV. and Rameses II., triumphs of the Egyptian art of preservation.

E. A. P.

AMERICA

The William L. Clements Library of Americana at the University of Michigan.— **Ann Arbor.** Published by the University. 1923. 9 × 6, pp. xii. + 228.

This is a praiseworthy attempt to present a catalogue, or at least a select bibliography, in a readable form with some literary pretensions. The library

which Mr. Clements apparently endowed, though he does not say so, and which he describes here, covers American history down to the Revolutionary period. The method followed in this book is to outline briefly the main events of each period, to describe the chief sources for the history of each, and then to discuss their relative values. The result is a clear condensed survey of American history. The books that are contained in the library are indicated by giving the place and date of printing. For the convenience of those using the library some more obvious plan might have been adopted, but for those who will only use the book as a skeleton bibliography this is no great matter. The library was started by the acquisition of the books of Mr. A. J. Cooke, an American collector, in 1903. To it considerable additions have been made from time to time, notably from the Huth and Hoe libraries. In 1922, the collection of the late Henry Vignaud was purchased by the University, and the appropriate books given to this library. For the historical geographer the earlier chapters are naturally of greatest interest. It would be impossible to give here an adequate indication of the scope of the collection. From the ancient and medieval geographers, such as Ptolemy, Solinus, and Pomponius Mela, to the men of the Age of Discovery, Columbus, Vespucci, Peter Martyr, Las Casas, and the chroniclers Eden, Hakluyt, De Bry, the ground is thoroughly covered. There are also interesting association books, for example, Harrisse's copy of Hakluyt's edition of Peter Martyr, printed at Paris in 1587. As one reads these chapters one can obtain a good idea of the rate at which the knowledge of the new discoveries spread through Europe, by noting, for instance, the various editions of Columbus' letter to the Treasurer, of Brant's 'Ship of Fooles,' or, later, of Cortes' letters. When one remembers that most of these books left Europe quite recently, a large proportion from this country, one cannot but regret that their true value was not realized before the entrance of American competition placed them out of the reach of many of our libraries.

The Mexican Nation : a History.— **H. J. Priestley.** London: Macmillan & Co., Ltd. 8½ × 6, pp. xix. + 507. *Sketch-maps and Illustrations.* 16*s. net.*

As regards a true understanding of its history, there can be few countries more unfortunate than Mexico. Its best-known incidents are the conquest by Cortes and the revolutionary outbreaks of the present day. For the intervening centuries, as Prof Priestley comments, the attitude of the Anglo-Saxon is one of half-pitying contempt towards the efforts of swashbuckling Spaniards, miserable half-castes, and more miserable Indians, to evolve a common polity. To dismiss the fortunes and results of these efforts as valueless is natural, but mistaken. It is true that the Spanish régime was one of absolute centralization and of economic exploitation for the benefit of Spain, but Prof. Priestley rightly insists upon measuring it by contemporary standards, and is able to show that in the heyday of the Viceroyalty Mexico enjoyed considerable prosperity. One misfortune has been the survival of a less valuable legacy from this period, the tradition of autocratic rule. This is incidentally one of the differences between Mexico's history and that of the United States. It accounts for the continual prominence of individuals such as a Diaz or a Carranza. This combined with a further tendency has brought about the present state of affairs.

When Mexico threw off the Spanish yoke, for a time it ceased to be a "colonial" country. Unfortunately, its great natural wealth proved only too attractive to foreign investors, so that Prof. Priestley can write, "Mexico

is still a colonial nation in spite of her fictitious and rickety independence." Since her mineral resources will some day be exhausted, and her agriculture is largely in the hands of "absentee" owners, her future is unsettled. The problems arising out of these conditions must be solved if Mexico is to complete the work of the revolution and the expulsion of the French, and achieve true nationhood. As the writer points out, success can only come if the other nations interested display disinterestedness and understanding towards Mexico. The spirit in which this book is written, the impartiality with which delicate international subjects are treated, and the interest in Mexican affairs which its appearance implies, give ground for hope that this sympathy will not be altogether withheld.

English Colonies in Guiana and on the Amazon; 1604–68.— James A. Williamson. Oxford: Clarendon Press. 1923. 9 × 6, pp. 191. *Sketch-map.* 12*s.* 6*d. net.*

Mr. Williamson, from scattered contemporary sources, has effectively filled in the outline of a little-known period in English colonial history. It will come as a surprise to some of his readers to learn that Guiana was once a serious rival to Virginia as a sphere of colonization. Indeed, as Mr. Williamson records, the Pilgrim Fathers discussed its suitability for their purpose. The attention of Englishmen was first generally attracted to this quarter by the expeditions of Sir Walter Raleigh in search of El Dorado. It is suggested here that the legends concerning this golden city were put about and purposely fostered by the Spaniards in order to draw off English raiders from Spain's really valuable possessions. In any case, the discoveries of the Spaniards in Peru would form a sufficient basis for such rumours. Raleigh's fellow-countrymen, however, devoted their energies to less spectacular ventures though without much greater success. In the gap between the Spanish and Portuguese spheres, along the Oyapok and the Amazon, several English posts were established from 1604 to 1668, as well as French and Dutch. The first expedition under Charles Leigh met with initial success, but ill health and internal dissension brought it to an end within two years. It had shown that flax, cotton, and sugar could be grown successfully. Other ventures followed under Harcourt and North, who were the moving spirits in the formation of the "Company of Adventurers to the Amazon," 1619, and the Guiana Company, 1626, both of which failed mainly owing to the direction in which events at home were moving. It was not, in any case, the climate that was responsible for these failures: one expedition, it is recorded, "alalong from their first landing injoyed thier health." The fundamental cause was the proximity of the Portuguese, who were not prepared to watch the establishment of settlements by other European nations in regions they had long regarded as their own preserve. In 1623 a vigorous Portuguese offensive from Para destroyed all the upper plantations along the Amazon—English, Dutch, and French, and nine years later the Amazon fort of the Guiana Company suffered a similar fate. The last English colony on the mainland, the settlement of Barbados planters at Surinam, was finally given up to the Dutch in exchange for New Amsterdam in 1668. Private enterprise had failed to assert itself in the face of vigorous Portuguese action. But there is another aspect of these plantations which accounts for their failure. The settlers relied almost entirely upon native help and labour: though the natives were at first generally favourable to the English, their attitude changed and with it the prospect of permanent settlement. "The Christians which live in this country take no paines nor labour for anie thinge: the Indians both house them, worke for

them, bring them victualls and theire commodities for a small reward and price." Therein lay the difference between Guiana and Virginia.

Among Wild Tribes of the Amazons.— Charles W. Domville-Fife London: Seeley, Service & Co. 1924. 8½ × 5½, pp. 282. *Sketch-maps and Illustrations.* 21*s. net.*

Tropical America exercises a remarkable fascination over many people who themselves can never hope to see it. Here then is a book they may welcome; it will increase the spell, and almost lead them to imagine they have been assisting in Amazonian exploration. It presents in a very readable way the impressions of one who for the first time ventured to wander into hidden recesses of tropical waterways and dense forests, there to make some acquaintance with aboriginal tribes. People at Pará in 1920 were eager to give our author information; "although as this, my first journey in Amazonia, was to take me into the unknown forests of Matto Grosso, from the upper reaches of the Tapajós river, little guidance could anywhere be obtained." But it would seem that Mr. Domville-Fife was imperfectly acquainted with the results of Chandless, Coudreau, Nery, Castelnau, Robuchon, Gabriel Sala, Church, and others, whose writings are easily accessible, and are indeed mentioned in his first chapter.

Amazonia is divided by the author into the known, the little known, the unknown; and we are led to anticipate important results from the enterprise of one who chose the last for his field of action. But the geographical details he gives are not always easy to follow. He leaves Itaituba on the Tapajós, a river 1000 miles long, with two caboclos in a batelão (not "batalõe"), May 14; on May 28, morning, they are 189 miles above Apué, still therefore about 90 miles below the São Manoel. Three nights are spent with the Mundurucús, yet on the evening of May 28 we find them in 8° 6′ S. lat., entering the small river Martinho, which Castelnau places a little below the Cachoeira de Todos os Santos and the Rio S. Thomé; it is probably Coudreau's Igarapé do Achimari. Here they meet Apiacás—a man, three women, and some children. They call it 300 miles back to Itaituba, and reach that town after a six weeks' absence. They did not cross over to the Madeira.

Three canoe journeys were made from the Madeira. Leaving the railway the traveller ascends the Mutum-Paraná with two Caripunas, and that night reaches a Caripuna village, where he first sees the poisonous mandioca, so extensively used in tropical America. Returning to Humaitá, he takes two Toras Indians up the Madeira, passes the Mahissi, and ascends the Gy-Paraná ("river of the axe") for about 159 miles. Here he visits a Parintintin village. Next he goes down the Madeira to Manicoré, where he joins a batelão party who ascend the Aripuaná 225 miles in 18 days; in 7° 32′ S. lat. they ascend the Castanho, and then go up the Madeirinha, in which neighbourhood they come across the Itogapuks. Roosevelt and Le Cointe note these three rivers. Blake (*G. J.*, May 1916) and others have described the Rios Negro, Branco, Uraricoera, and Parimé; but it is distinctly interesting to have views of the curious Parimé rock. Other excursions were made up the Chimbiri-yacu, the Putumayo, and Ucayali.

The narrative of all these journeys is vivid and interesting, and there is a striking account of the Federal Government's Indian Service with its "Attraction Posts" for getting in touch with the natives. Mr. Domville-Fife makes no secret of his ignorance of native languages and of the difficulties of conversation by signs or through interpreters who know only a few words of English. The detailed information which he gathers and records in these

circumstances is remarkable, and he would probably be the first to admit the possibility that he was sometimes mistaken in his interpretations. But read with this necessary caution the narrative is useful, even though its geography is sometimes rather naive, and if the scene of the author's wanderings is hardly the absolute *terra incognita* which the uninstructed reader might be led to suppose it.

It is perhaps worth noting that the photo at p. 64 is of a "canôa de casca de pau," sometimes called "ubá," or wood-skin; it is not a dug-out: also that the Igara-Paraná is not in Guiana. J. W.

Head-Hunters of the Amazon.— **F. W. Up de Graff.** London: Herbert Jenkins. 1923. $8\frac{1}{2} \times 5\frac{1}{2}$, pp. xvi. + 316. *Sketch-map and Illustrations.* 16*s. net.*

In his foreword the author only claims for this book that it brings together records jotted down during seven years of wandering, first in the highlands of Ecuador and later on the Upper Amazon, where the borders of Brazil, Colombia, and Ecuador merge in a confused network of river and forest. A special preface by Mr. R. B. Cunninghame Graham eulogizes the pioneer spirit displayed and draws a parallel between the writer's adventures and those of Mr. Dyott, lately in the same region. Nevertheless there was a wide difference in the motives which prompted their journeyings. In Mr. Up de Graff's narrative there is much that every reader will deplore: time and opportunity wasted, malpractices condoned, the acceptance of standards too low for a white man, even in that trackless No-Man's-Land. There are better adventures open to youth than the exploitation of helpless Indians in rubber-gathering and gold-prospecting.

In some respects the author's chapters on Ecuador are the best in the book. His description of the mule mud-slides down the rain-soaked Pacific slopes will appeal to amateurs seeking fresh fields of sport. The philosophy with which he accepts the break-down of all his efforts to uplift the business and industrial world of Ecuador is also admirable. But what appeals most is the everyday narrative of his jungle experiences on the Amazon. There are phrases introduced, almost unconsciously, which could only be possible to one who for months together has had no home save the jungle and the river. Man's reaction to the Amazon region has nothing of that familiar affection which dwellers in distant climes usually acquire for the land which supports them. The background to all life on the Amazon is fear. "One is a prisoner of the forest," Mr. Up de Graff writes; again he speaks of his "last journey to that forlorn, unconquerable land." It is difficult even to hold one's own against Nature's exuberance. "It would take the greater part of a man's life to learn all the secrets of the forest; . . . never can he hope to acquire the wonderful knowledge, which is the essence of their existence for those who are bred and born in a world which is itself one boundless forest." There are of course some lighter moments even on the Amazon. As, for instance, when, suddenly awakened by the groans of his companion, the author discovered a large land-crab sitting on the latter's face.

The head-hunting episode explaining the title is given towards the end of the book. The reader must judge for himself the author's reasons for joining forces with a head-hunting tribe. Especially must he judge of the excuses made for the final fracas, when, owing to their sole possession and knowledge of firearms, the white men shot down their allies and commandeered all canoes and effects, including the war trophies of shrunken Indian heads which they

had already planned to obtain by barter, in order to re-sell as curios to European museums. This is not good reading.

The distances compulsory to travellers within the Amazon valley should be noted, with the aid of the sketch-map. Journeys of 600 or 700 miles, paddling upstream to find workable rubber groves in a corner of a region as large as Europe, were undertaken as a matter of course. The straw-thatched houses of Iquitos, 1000 miles from Manaos (which in turn is 1000 miles upstream from the Atlantic), were to these rubber-gatherers of the 'nineties almost as remote as Paris. In all probability these conditions still obtain. To those who may be tempted in a later day to adventure to the Amazon valley to find out we commend this book, with the advice to imitate Mr. Up de Graff's wanderings but not his methods. W. S. B.

AUSTRALASIA AND OCEANIA

In Primitive New Guinea.— J. H. Holmes. With an Introduction by **Dr. A. C. Haddon, M.A., F.R.S.** London: Seeley, Service & Co. 1924. $8\frac{1}{2} \times 5\frac{1}{2}$, pp. 304. *Illustrations and Map.* 21*s. net.*

Papua has been singularly fortunate in her chroniclers, and those who have written seriously of her primitive peoples have done so with sympathy and understanding, based on long personal experience. Mr. J. H. Holmes is no exception, and, as Dr. A. C. Haddon indicates in his introduction, he was well qualified to write this account of the Namau of the Delta Division and the Ipi tribes of the Gulf Division by reason of his long residence as a missionary in the district, and of his intimate acquaintance with the people and their language.

Mr. Holmes has approached his task in the spirit of the true anthropologist; he is at all times careful not to generalize from the particular; he does not deal in theories and he is diffident in drawing conclusions, even when he might legitimately do so. He deals with facts, faithfully and accurately recorded, in order that the reader may himself get the trend of the Papuan mind; and he portrays the lives of a backward race, survivors of the Stone Age, from the angle of the native himself rather than of the missionary. The Ipi group, as described by Mr. Holmes, is made up of a number of tribes living on the coast between Cape Possession and Orokolo, while those in the Purari delta compose the Namau group. When the author first came amongst them they were: "A wild, barbarous people, living their life according to their traditions. Inveterate enemies; loyal friends; ever cunning to secure their own ends; never treacherous except to their foes, when they regarded every means justifiable to achieve victory. Conquest was the ambition of their life; defeat was its direst calamity. Their craving to possess was childlike, their reluctance to give anything for nothing was pathetic."

Among these people the author lived and worked, and his book, long delayed, is the result of twenty-five years' minute and intelligent observation. He shows how the prevailing geographical conditions affected both groups, he gives an intimate picture of their home-life and occupations, of which fishing and hunting are naturally the most important. He describes their marriage customs, cannibal feasts, initiation rites, totems; recounts some of their legends, superstitions, and beliefs, and devotes a chapter to the question of language. In fact, he has covered all the ground in an admirable way. Besides this, however, his book is always interesting, with quick gleams of humour, and throughout is a breadth of vision that is not invariably associated with missionary writings. The conclusion he has formed of the people he has

so obviously come to love is encouraging ; now that they have given their friendship and goodwill to missionary, Government officer, trader, and planter, "they have responded wonderfully to the opportunities afforded them and have demonstrated that they are a virile people likely to hold their own in the great struggle for existence." As Mr. Holmes well says, although their obligations to us are great, ours to them are infinitely greater. By missionaries such as Mr. Holmes and by resident magistrates such as the Papua Administration seems to breed, it is certain that these obligations will be met.

The map is adequate, but the index might have been elaborated with advantage. O. R.

Human Australasia.— Studies of Society and of Education in Australia and New Zealand. **C. G. Thwing, LL.D.** New York: Macmillan. 1923. 8 × 5½, pp. vi. + 270. *12s. net.*

This is just such a study as we are accustomed to have from the pen of President Thwing, and will appeal to those who are interested in his work. It is clearly written, in good and crisp English ; but it is rather "thin" and very optimistic. It has practically no geographic interest or importance. Even the chapter on "A White Australia" makes no real attempt to discuss the climatic problem: "one scientist has said to me that, for the time being, the effects (in Northern Queensland) were not evil." The best chapter is on "The Human Product," which is well described as reasonable, earnest, and full of good-will. The rest of the book, dealing with industrial matters, education, religion, literature, and journalism, is little more than a non-platitudinarian presentation of various platitudes political and otherwise. The "Contributions to the World's Civilization," following Prof. Atkinson, are spun out to nineteen in number ; they can really be reduced to three or four, and many of them were as truly contributions from the Wessex of Alfred the Great as from modern Australia. L. W. L.

HUMAN AND HISTORICAL GEOGRAPHY

The Romance of Colonisation.— **Arnold Wright.** London and New York : Andrew Melrose, Ltd. 1923. 9 × 5½, pp. xviii. + 388. *15s. net.*

Mr. Arnold Wright's 'Romance of Colonisation' is perhaps better described by its sub-title, 'The Story of the Economic Development of the British Empire,' and by his statement in the Preface, that he writes "to supply for popular reading a plain, straightforward account of the manner in which the trade of our Empire has been developed from the earliest days to the present time." In this he has succeeded, and his account is not only plain and straightforward, but also clear, interesting, and well informed. His point of view, too, gives a certain originality to his treatment of the subject, for histories of the British Empire do not as a rule sufficiently explain and stress the commercial interests which have played so important a part in British expansion. In most histories the political aspects of the story efface the commercial, and, except in certain familiar episodes, as the early history of our relations with India, the work of statesmen, soldiers and administrators tends to exclude that of the merchant. Mr. Wright is fullest on the early period, and gives a good account of the Virginian tobacco trade, the Newfoundland fisheries, the rise of the sugar trade, the slavery of whites, and the slave trade ; in later times he selects his topics, and while he has a good deal to say on coffee, gold, and diamonds, British Malayan tin, plantation rubber, and the exploitation of the mineral resources of some parts of the Empire, we find very little about wool, wheat,

fruit, cotton, frozen meat, dairy products, though without these commodities the trade of some parts of the Empire would have been very small. He passes very lightly over the period that followed the loss of our American colonies, and seems to antedate a good deal the change in our colonial and commercial policy which followed, though not, as he suggests, directly, from that catastrophe.

He gives a chapter to "A Teutonic bid for Eastern trade," which seems to have no vital connection with the subject, more particularly as our serious commercial rivalries with the Dutch and the French receive no similar treatment. He refers to Prince Eugene as the son of the Emperor Charles VI., but Prince Eugene was the son of a French Count and an Italian mother. But the book is full of information and very readable, and demonstrates what Mr. Wright claims, that the British in their imperial history have shown "a genius not merely for distant rule but for the association with their rule of productive schemes of imperial development." E. A. B.

GENERAL

History of the Great War based on Official Documents: Naval Operations. Vol. 3.— **Sir Julian S. Corbett.** London: Longmans, Green & Co. 1923. 9 × 5½, pp. xiv. + 470. *Maps.* *21s. net.*

Sir Julian Corbett's third volume of the naval operations of the great war covers the period May 1915 to June 1916, and includes the Battle of Jutland.

No clearer nor more interesting account of that eventful time could be given us than is found in these pages. The Battle of Jutland is brought vividly and comprehensively before us; helping us to realize the magnitude of the engagement; the collective and individual devotion, gallantry and skill, not only of those guiding and directing operations, but of the rank and file—officers and men, of battleships, cruisers, and destroyers. We can visualize the vast area of the battle and can appreciate the marvellous accuracy of gun fire at great distances in reading these pages. We marvel at the skilful handling of so vast a fleet by Admiral Jellicoe while realizing that in Admiral Scheer he encountered an opponent as skilful and as brave as himself. The loss of life and of ships was, unhappily, heavy, and ours must be adjudged a "Pyrrhic" victory.

The book is well illustrated by plans. A supplementary set of plans in a separate case is added. All are clear and good, but one thinks that a folding sketch-map of the British Isles, with the adjacent seas and the shores of the Continent, would be valuable for using with the plans, as one could then more fully follow the respective positions of the combatants.

The death of Sir Julian Corbett is a sad loss. For many years he devoted himself to the study of naval history and tactics. His clear intellect and fairness of judgment are conspicuous in every chapter of this work. Fortunately, he had finished this volume before he died. The collecting of data, figures, etc., must have involved an enormous amount of work and research. It must often have seemed well-nigh impossible to extract the real facts from apparently conflicting evidence. The three volumes are a splendid memorial and a testimony to the author's undaunted perseverance and triumph as a narrator and historian.

The work was checked throughout, and where necessary revised, by Lieut.-Colonel E. Y. Daniel, R.M. (Secretary of the Historical Section of the Committee of Imperial Defence). The diagrams (as also those in previous volumes) were prepared by Lieut.-Commander J. F. H. Pollen, R.N. (ret.).

D. W. B.

Battles with Giant Fish.— **F. A. Mitchell Hedges.** With Illustrations from Photographs by **Lady Richmond Brown.** London: Duckworth & Co. 1923. 9 × 6, pp. 300. 21*s. net.*

Before he set out upon the remarkable expedition which is recorded in this book, Mr. Mitchell Hedges inclined in spite of popular scepticism to a belief in the existence of sea-serpents and other monsters of the deep. Besides settling this question to his own satisfaction, he can also claim with justice to have initiated the sport of "big game" fishing, a pastime which certainly seems to provide all the danger, thrills, and tests of endurance that the most ardent sportsman could desire. The opening scenes of Mr. Hedge's adventures were staged in the Caribbean Sea, mainly off the Black River, Jamaica. Among the catches made here under exciting circumstances were a 410-lb. whip ray, and a 237½-lb. shark caught on a rod and line. His activities also had their useful side, for he was able to rid Kingston harbour of a shark which had killed a bather. But it was only when he left the Caribbean for the Pacific in the neighbourhood of Panama, that the sport became really fast and furious. Against the sharks of these waters, tackle of ordinary dimensions would have been useless. Accordingly, steel hooks and chains were made, each weighing 14 lbs., while the line varied from quarter to half-inch Manilla. After the fish had been hooked, the plan of campaign was to allow it to tow the 20-ton steam yacht, while Mr. Hedges approached in a small boat and finished it with a rifle. In this fashion a 5700-lb. sawfish was caught, and another weighing 1¾ tons was landed by harpoon. Besides accounts of these and many other exciting "chases," the book contains descriptions of crocodile shooting in the Bayano river, of fights between sharks, and notes on the habits and biology of the deep monsters encountered.

Unlike most fishermen's yarns, Mr. Hedge's narrative is illustrated by many excellent photographs—over sixty in number.

Studies in Tidal Power.— **Norman Davey.** London: Constable & Co. 1923. 10 × 7¼, pp. xiv + 255. *Illustrations. Price* 32*s. net.*

This is an excellent book on a subject which the author considers has not received the attention it deserves. He makes out a good case for utilizing the tides in certain of the estuaries of the British Isles, supporting this by calculations which go to prove that tidal power, both for capital expenditure on plant and working expenses, compares favourably with steam power for generating electricity. He analyses the methods which might be utilized, and concludes that the outward flow single-basin system is usually the best. A useful table comparing the different systems is given on page 58. In chapter v. the methods available for storage of energy are fully considered, and the resulting over-all efficiency. This appears to be under fifty per cent. in most cases. In chapter vi. we have a useful survey of the tidal power available in the British Isles, and a list of seventy-two localities is given where the land conformation allows of adequate areas being enclosed with a minimum of dam construction. The Severn scheme is fully considered in chapter viii., and the author's conclusions appear on the whole to bear out the figures for power available upon which this scheme was based. The author is of opinion that where variable and intermittent power may be absorbed there is an extremely strong case for the exploitation of tidal power, and he particularly emphasizes its suitability for the electro-chemical process of nitrogen fixation. There are three appendices, one of which gives the tidal constants for the British Isles, another maps of the estuaries referred to as suitable for exploiting

tidal power, and the third a list of English patents in tidal power from 1856 to 1920. The case is presented in a clear and accurate manner, and the book should prove of great value in bringing before the public the possibilities of the tides as a source of energy. J. S. O.

Selected Papers on Anthropology, Travel, and Exploration.— Sir Richard Burton, K.C.M.G. Edited by **N. M. Penzer.** London: A. M. Philpott, Ltd., 1924. 9 × 6, pp. 240. 15*s. net.*

Mr. Penzer has done good service by collecting in more accessible form the stray papers which Burton had contributed to the journals of various scientific societies and periodical magazines. The collection emphasizes the versatility of the man, and on each paper there is a masterly impress which unfailingly captures the interest. Burton concentrated himself on each subject with forceful energy, and he had the artist's secret of making his subjects really live.

Yet on reading these papers the feeling does come across us that with all his talents and with all his courage and industry he just missed true excellence. He gives the impression of having devoted too great a proportion of his attention to the lower minutiæ of life, and too small a proportion to those higher aspects which really determine life. We marvel at his cleverness in adopting and maintaining disguises. We realize the unceasing alertness, the daring, the accurate knowledge of intimate manners and customs which these disguises must have required. Yet we wonder whether, after all, he ever came to know the heart and soul of a people so well as, say, a Doughty, going in among them frankly as an Englishman and interesting himself more in their inmost springs of action, would understand them.

The second paper in this collection entitled "The Guide to Mecca" contains a striking picture of the pilgrimage to Mecca. Burton makes us feel the hardships and the dangers the pilgrims have to endure, he describes in detail the ceremonies they have to perform, and he gives a much more generous appreciation of Muhammad than was common in his day. And yet somehow we feel that he was still a long way from understanding what it was in Muhammad and in these millions of followers that they have for a thousand years been attracted from North and South and East and West, over mountains, seas, and deserts, to the places where he lived and died. And we have the impression that Carlyle, who had never been within 3000 miles of Mecca, and probably never seen an Arab in his life, had got nearer to understanding the inner springs of Muhammad and Muhammadans than Burton ever did.

There seems to have been lacking in Burton some refinement of soul which, if he had possessed it in addition to those other wonderful gifts to which these papers amply testify, would have made him one of the very greatest in the great age in which he lived—though this is said not for the purpose of disparaging Burton but in order that we may profit by his experience. It is true that a man with higher refinement of soul and a less consummate knowledge of the technique of native customs might have lost his life in situations where Burton survived. On the other hand, he might have reached nearer to the truth—and it is truth that men of science are out to find. F. E. Y.

THE MONTHLY RECORD

EUROPE

West of England Tin-mining.

THE present attempt to rehabilitate the tin industry in Cornwall gives additional interest to a concise outline of its history by W. S. Lewis, 'The West of England Tin Mining' (Exeter, 1923). The distribution of tin in the peninsula is closely related to those granitic intrusions which have also influenced its physical characteristics. During the Carboniferous period the Primary strata were subjected to considerable distortion, producing east-and-west folding. This was accompanied by a welling up of molten igneous material in the anticlines. The lodes of tin are found in the fissures, running roughly east and west, along the line of contact between granite and slate. These veins are richest where the granite runs below the slate at a low angle, as in the St. Just and Carn Menellis masses. The Carn Brea area in the latter region has been the centre of the industry; other zones of importance are located around Hensbarrow and in the Bodmin–Tavistock belt. All the veins tend to decrease in importance as they run eastward. Not all the tin occurs, however, in lodes. The denudation which the rocks have undergone, first by glacial and then by water erosion, has, by removing the lighter *débris*, left deposits of the heavier tin behind. These "placers" are found on shallow upland flats or "moors," in the west of the peninsula, and in the valleys of the streams draining them. The valleys rich in "placer" tin all open to the south, while the richest lodes are found near the northern coast. Naturally, the early miners sought out these deposits first: there can now be few left. It is difficult to assign a definite date to the commencement of the British tin industry. Recent research tends to discourage the identification of the "Cassiterides" of ancient times with the Cornish tin regions. From a letter of William de Wrotham, Warden of the Stannaries, written in 1198, it may be inferred that the work was organized by that date. By the thirteenth century the Stannaries were a source of great revenue to the Crown. Shaft mining was probably introduced in the following century. The problems which this new process raised, such as drainage and the location of veins, with the unsettled conditions accompanying the French wars, caused the prosperity of the industry to fluctuate during the next two centuries. In the sixteenth century, too, the competition of Saxon and Bohemian tin was making itself felt. Previously it could be said, "All Europe was supplied with tin by Cornwall." The chief *entrepôt* centres for the trade were successively Cologne, Bruges, and Calais. Then, with the development of the sea-routes, and particularly the opening-up of the tin deposits of Siam by the Dutch, came the decline of the Cornish industry. The introduction of tin-plate manufacture into South Wales in 1730 improved the situation for a time. In spite of competition, the output rose steadily during the nineteenth century, owing to the world-wide demand. This in itself stimulated the development of further deposits in the Malay States and Australia. Before this renewed attack the Cornish industry collapsed. The output, which in 1870 stood at 15,234 tons, had by 1896 fallen to 7663 tons. Such fluctuations in prosperity had caused the emigration of the workers or their absorption in other industries, thus increasing the obstacles confronting a revival of tin mining. Mr. Lewis also discusses the methods of work, the condition of the miners, and the location of old sites.

Col Major and Col du Géant.

In the controversy over the progressive extension of glaciers and the continual cooling of the Earth, the case of the Col Major is frequently cited.

By some it is held that this Col, once easily practicable, has become changed into the Col du Géant, now accessible to climbers alone. This theory is held by Rev. W. A. B. Coolidge against Mr. H. F. Montagnier, who maintains that the passage between the valleys of Chamonix and D'Aosta has always lain over the Col du Bonhomme and the Col de la Seigne. The discussion is summarized in *L'Echo des Alpes*, October 1923, by H. Ferrand, under the title "Un problème de géographie alpine." The col was first traversed, by M. Exchaquet, in 1787. The early visitors were told by the inhabitants that the col had once been practicable, but was now closed by ice. Windham, in 1741, recorded that tradition said it was once possible to reach the Val d'Aosta in six hours over it. Pierre Martel, the Duc de la Rochefoucauld d'Enville, and A. C. Bordier all testify to the existence of this tradition, which was also current on the Italian side. It is pointed out, however, that similar traditions are attached to other Alpine passes, and in this case a precise locality is not indicated, nor is the name Col Major applied to it. It first appeared in Blaeu's Atlas of 1640, as *Col Major* or *Cormoyeu*. M. Ferrand thinks that this is a corruption of the name of the neighbouring village Courmayeur, which was taken by cartographers to belong to a mountain pass, and copied indiscriminately by succeeding generations. The pass thus marked on Sanson d'Abbeville's map of the Gouvernement Général de Dauphiné, relative to Chamonix, appears to occupy the position of the Col du Dolent. On the other hand, it is not marked on the large-scale map of T. Borgonio (1680), who was better acquainted with the region. M. Ferrand, however, lays more emphasis upon the omission of all mention of the name in the traditions current around Chamonix. He thinks it may have been applied to the Col de la Seigne. The name Col du Géant was bestowed in 1788 by M. de Saussure, but neither he nor Bourrit makes any reference to a former name. The identification of Col du Géant with Col Major rests upon a statement by Alphonse Favre, writing in 1860, which has since been adopted without justification. In M. Ferrand's opinion the name Col Major had never been bestowed upon a distinct and individual pass.

Distribution of Population in Southern Germany.

An analysis of the 1919 census returns for South Germany is given by N. Krebs in an article, "Die Verteilung der Bevölkerung Süddeutschlands auf geographische Einheiten" contained in the *Zeitschrift der Gesellschaft für Erdkunde zu Berlin*, 1923, No. 5–7. The region dealt with is that south of the Main, and comprises the upper valleys of the Rhine (except Alsace and Basel) and the Danube, a total area of 117,140 sq. km., with a population of 13,668,000, giving an average density of 117 per sq. km. This area is divided up into 131 anthropological sections, for each of which the area, population, and density are given. Of the thirteen larger divisions into which it is divided, the Upper Rhine lowlands (roughly Wiesbaden to Basel) is the most densely populated, with 368 persons per sq. km. This covers only 7·9 per cent. of the total area, but supports 24·7 per cent. of the population. The next heavily populated areas are the Swabian basins (Stuttgart and the Neckar valley, 174 per sq. km.), the Danube lowlands, centred about Ulm and Regensburg (139), and the Franconian Keuper region (119). Grouping the areas according to their morphological character, the result is: plains, 10·5 per cent. of area, 23·6 per cent. of population; foothills and terraces, 28·9 per cent. of area, 27·9 of population; and so on, ending with the Alps, 4·0 per cent. of area, 1·1 per cent. of population. If these are divided into two main groups, open land and woods and mountains, the ratio of area between them

is 3 : 2, and of population 4 : 1. In towns and industrial regions 34 per cent. of the population is concentrated within 4 per cent. of the area ; for intensive agriculture, the figures are 43 per cent. and 49 per cent. respectively ; for extensive agriculture 23 per cent. and 47 per cent. These figures show that in Central Europe purely agricultural areas have a density of 60–80 per sq. km. If forests and pasture predominate, it falls to 40–60, but with vineyards and orchards it rises above 100. Great concentration is shown by the district known as the "Bergstrasse": in 1861 it was somewhat over 150 to the sq. km., now it is 442; in the predominantly agricultural regions of the Palatinate, Hessen, etc., it remains at 145–170. With the "saturation point" still to be reached, over-population and stagnation are prevalent. As one goes south through the Upper Rhine plain the density of population falls away, and with it the quality of the agriculture, though the fertility of the soil remains unchanged. Besides the movement to the towns, emigration has been heavy since 1880. In Würtemberg the country population increased by about 70,000 between 1834 and 1910, but in the last decade was practically stationary, whilst the city and population grew steadily from 360,000 to 1,224,000.

Journey in the Urals and Northern Russia.

The well-known geologist and traveller in Persia, Dr. A. von Stahl, describes in *Petermanns Mitteilungen* for 1923 (pp. 166–170, with map) a journey made by him in the summer of 1916 on the eastern side of the middle Urals to about 61° N. as well as a voyage on the Vychegda river, the great eastern tributary of the northern Dvina. These regions lie sufficiently off the beaten track to make this narrative of some interest, especially as regards the mineral resources of the tracts visited on the eastern side of the Urals. Even in 1916 mining seems to have been considerably dislocated by the war, a good many of the establishments having been closed down, though some were being worked by the help of Austrian prisoners of war. The journey was undertaken in connection with the project for a railway from the eastern foot of the Urals to Kotlas on the Dvina, with a view to a connection with the Murman railway—a project which was never carried out. The starting-point was Verkhoturye, in about 58° 50′ N., whence Dr. Von Stahl had already made various journeys towards the mountains to the north-west, and he is thus able to give a general sketch of the geology of this part of the range, which attains a considerably greater altitude than the sections north and south of it, and forms regular peaks or *Kamens*, of which the Konjakovski-Kamen has a height above sea-level of 1689 metres. The geological formations range from Archæan on the eastern side (chiefly schists of various character, gneiss and granite being but slightly represented) to Recent, but Mesozoic rocks were not observed on the surface. The formation best represented on the eastern side is the Lower Devonian, while the Middle and Upper Devonian, with Carboniferous and Permian, are only found on the west. Recent deposits, which cover large areas of both the Ancient and Tertiary strata, include glacial sediments, gravel, clays, and sands. As is well known, the eastern side of the Ural is particularly rich in useful minerals (gold, copper, iron, platinum, etc.), and the paper mentions the localities in which the various kinds are principally worked, giving particulars also of the various inhabited centres and the composition of the population. Before the war a large area around Nikolaye-Pavdinsk was worked by a French company, but the largest undertaking was that of the Bogoslovsk Mining Company, which had lately struck valuable veins of copper ore and produced as much as 4 million kilogrammes of copper in the year. Washing for gold and platinum was almost at a standstill at the time of Dr. Von Stahl's

visit on account of scarcity of labour, but a new platinum locality had lately been discovered, and is said to be now being worked. Much of the country is still covered with forest, which is exploited both for timber and for charcoal. The journey through the forest was very trying by reason of the heat and the swarms of mosquitoes and other insects, which made sleep almost impossible. The latter part of the paper gives some useful particulars about the country and people of the Vychegda basin and the *régime* of the river. As in other parts of Russia the water falls very low in summer, and this is ascribed to the effects of lateral erosion in widening the river-beds, rather than to destruction of the forests, which has not proceeded far in this region.

ASIA

Harbours of the Hejaz Coast.

The coast of the Hejaz in western Arabia is indented by small bays or inlets in the coral banks which serve as havens for the native coastwise shipping, though inaccessible to ocean steamers. Their origin is discussed by Dr. W. Schmidt in *Petermanns Mitteilungen*, Heft 5–6, 1923, and is explained as due to tectonic-geological causes. The edges of these bays descend perpendicularly to the sea, their height in the north being from 9 to 12 metres, but only 4–5 metres in the south. The characteristics of these inlets are as follows: (1) Each is cut perpendicularly in a horizontal layer of coral, which sometimes overhangs; (2) it receives the waters of small streams (*widân*) from the interior, and often has a brackish swamp at its head; (3) there is a marked absence of coral islands and shallows off its mouth; (4) all run in a north-south direction; and (5) this direction is generally found to be continued along the coast to the south and (6) to be repeated out to sea in various portions of the isobathic lines. The formation of these havens is therefore closely connected with the tectonic evolution of the Red Sea. During Early Miocene times the unity of the African and Arabian tablelands was broken by the sinking of a portion of the surface between two parallel lines running S.S.E.–N.N.W., and extending to the entrance of the sea. At the same time, this rifting was also accompanied by a subsidiary N.–S. movement, which apparently only reached the present coastline at a few places. To these movements, repeated in Upper Pliocene times, the havens owed their development. At this latter period these clefts were under water, and the coral layers were formed. Subsequently their present form was acquired as the result of very heavy erosion by rain and streams during a period of greater precipitation, these streams being diverted from their orographic east-to-west direction into a southerly one by the tectonic configuration. With a further lowering of the sea-level these inlets will cease to serve as havens, for their form will be neither wide enough nor deep enough.

Steam Traffic on the Yangtze; Population of Szechwan.

Referring to the review of Sir A. Hosie's book on Szechwan in the *Journal* for January last, in which it is stated that "steamers now run profitably between Ichang and Chungking, the winter months excepted," a correspondent writes that steamers are now running profitably for *eleven* months of the year; also that they now ply as far as Suifu on the main stream and Kiating on its tributary the Min. He also considers that Sir A. Hosie's estimate of 45,000,000 for the population of Szechwan is too low, as does also Mr. M. T. Stauffer in 'The Christian Occupation of China,' reviewed last year in the *Journal*. But, as the latter points out, the various estimates of population hitherto made differ enormously, the Minchengpu census of 1910 putting it as low as 23,000,000,

while some authorities suppose it to be nearly 70,000,000. All that can be said is that it is probably over 50,000,000 and under 70,000,000.

AFRICA

Game and Shooting in Tunisia.

The following details have been supplied by Mr. Mitcheson, H.M. Vice-Consul-General, through the Department of Overseas Trade. Sportsmen intending to shoot in Tunisia must obtain a permit and shooting licence from the "Direction de la Sureté," Tunis. The close season is fixed by the authorities each year, but it generally extends from March to September. The shooting of flamingoes and Barbary deer is forbidden altogether, while a special licence is necessary for Moufflon (Barbary sheep) and grand antelope (Addax). Shooting is free in all parts of the territory except in the State forests, where a special licence is required, and on cultivated land, unless the permission of the owner is obtained. There is usually little difficulty in this respect. The last lion was shot near Tabasca in 1891, and panthers are also very rare. Wild cat (*Felis ocreata*) is fairly common in all the forest districts; in the south hyena, and in the mountainous districts lynx are fairly plentiful. The jackal is common all over the country except near the southern desert. A small variety of wild boar is to be found in the north-west forest region. A herd of buffalo, about fifty head, the personal property of the Bey, still exists, and permission to shoot may be sometimes obtained. The Moufflon thrives on all the mountains of southern Tunisia, and also in the desert beyond the "Schotts" or inland lakes. Of gazelles three kinds are found, the ordinary (*Gazella dorcas*), the white gazelle, and the mountain gazelle, though the last two are becoming very rare. The ordinary gazelle, too, is now rarer, herds of thirty being found in place of the herds of a hundred or more formerly common. It is hunted chiefly in the hills behind Gabes, and owing to the difficulties attending the chase, it is a favourite quarry. The variety of partridge known as *Gambra* is plentiful all over Tunisia, and quails are extremely numerous in March and April. Woodcock migrate to the wooded north-west frontier in November, remaining there during the winter. Snipe and wild duck are plentiful, particularly around Ishkeul. In the plains round Kairwan bustard and crane are abundant.

Cotton-growing in the Sudan.

The first section of an extensive irrigation scheme on the Blue Nile above Khartoum is now nearing completion. The scheme, which will provide about 300,000 acres for cotton-growing, is financed by the British Government under the provisions of the Trade Facilities Act. A dam approximately 2 miles wide and 90 feet high is being built below Makwar, 160 miles south-east of Khartoum. From this point a main supply canal, 62 miles in length, will carry the water to the irrigation area, where it will be distributed by a system comprising 535 miles of minor canals, 3125 miles of subsidiary canals, and 5625 miles of field canals. All the water used will be subordinate to Egypt's requirements. The scheme has been designed so that it can be extended, when desired, to enlarge the area under irrigation to one million acres. Under the terms of the contract, the works are to be sufficiently forward to allow the first crop to be raised in 1925. Another region in the Sudan has lately been opened up by the building of the Kassala railway, which was formally opened on April 23. The new line leaves the Suakin–Khartoum railway at Haiya, 6 miles west of Thamiam, and after running along the Nile–Red Sea water-

shed, reaches Kassala, 216 miles away, by the valley of the Gash. The object of the railway is to provide an outlet for the produce of the Kassala Cotton Company, which is carrying out extensive irrigation schemes in the neighbourhood. In the present year it is hoped to have 15,000 acres under *skellridis* cotton. The railway will also tap the resources of the south-eastern Sudan, especially when the projected extension to Gedaref, and ultimately to the El Obeid–Khartoum line at Makwar, is built. The dam at Makwar, mentioned above, is designed to carry this railway line. When finished, this new line will provide a short route from Kordofan and the western Sudan to the Red Sea.

AMERICA

The First Separate Map of Pennsylvania.

A small point of historical interest in connection with the first settlement of Pennsylvania has been cleared up by Mr. Worthington C. Ford, who has succeeded in identifying the map of that region made in 1681 to accompany a folio tract of eight pages, in which Penn gave 'A brief account of the Province of Pennsylvania' for the benefit of intending settlers. The manner in which the identification has been arrived at is explained by Mr. Ford in a short article in the publication of the Massachusetts Historical Society for November 1923. Of the tract referred to only four copies appear to be known (one being in the British Museum), but none of these is accompanied by the map referred to at the end of the tract as having been printed "together with a description at the end of it." Nor is there any mention of the map in the other tract issued by Penn in the same year under the title 'Some Account of the Province of Pennsylvania.' It has sometimes been assumed that the map in question was that of Thomas Holme, issued without date by Robert Green and John Thornton; but he was not appointed Surveyor-General by Penn until April 1682, and it has been proved conclusively that he could have had no part in preparing the map of 1681. The only other known map which might come into consideration is that sold by John Thornton and John Seller for which the date 1683 has been conjectured. Mr. Ford has however come upon a copy of this last map in the John Carter Brown Library with a printed statement, in four columns, attached to the bottom edge; this is no doubt the description written to accompany the map of 1681, which must therefore have been Thornton and Seller's. It differs entirely from Holme's map, being made in anticipation of settlement, while the other is a surveyor's map made to record what had been accomplished, showing, *e.g.*, the location and laying out of Philadelphia. Mr. Ford prints the "Description," which sets forth Penn's title to the province, the nature of the country, its products and inhabitants, the prospects of settlers and conditions of occupation, and so on. It is in fact a shortened and modified version of the 'Brief Account' above spoken of.

The Reindeer Industry in America.

Under the above title Prof. J. Russell Smith contributes to the *Scottish Geographical Magazine* for March 1924, an interesting account of the saving of the Eskimo of Alaska from starvation and ultimate extinction by the introduction of reindeer from Siberia. Incidentally, as his sub-title "A Study of a New Industry and also of the Origins of Geographic Error" shows, he endeavours finally to dispel the popular conception of the Arctic as an inhospitable region of eternal snow and ice. Apart from the vitality of spectacular travellers' tales, he attributes the currency of this idea to the propaganda work of bodies, such as the Hudson Bay Company, who, being fur-trading concerns, would

naturally wish to prevent the settler from encroaching upon their domain. Thus, in giving evidence before a select committee appointed in 1857 to investigate this question, a governor of the company stated that, in his opinion, the coast of Victoria, B.C., amongst other regions, was "quite unfit for colonization." With regard to the particular point of his paper, Prof. Russell Smith argues that one of the mistakes of colonization methods up to the present has been the practice of taking domestic animals from warm to colder climates, instead of attempting to domesticate an animal suited by nature to the colder environment. The history of the reindeer industry in Alaska certainly gives weight to this contention. In 1890 the Eskimo of Alaska were on the verge of extinction through starvation, following upon the destruction of their former animal food supplies by the whites. Mr. W. T. Harris then recommended the introduction of reindeer from Siberia, and as the result of appeals to charity a few animals were introduced. In 1892, when the United States Government took the matter up, 171 animals were brought over. This original stock, with further additions, making 1280 in all, has increased amazingly. Within four years it numbered 1000; by 1905 it had grown to 10,000; by 1915, to 70,000. This great increase is no doubt due largely to the regulations for the reindeer service enforced by the Government, and finally codified in 1907. The foundation of the industry is the apprentice system. After one year's apprenticeship to a herder, under Government supervision, the Eskimo receives six reindeer, at the end of the second year eight, at the end of the third ten more. After four years' apprenticeship, if efficient, he is certified as a trained herder. He, in his turn, must train and reward three apprentices over a period related to the growth of his herd. The Eskimo are said to display considerable aptitude for the work. In 1915 66 per cent. of the reindeer were owned by natives; but capitalistic organization by white men is beginning. A slaughter-house has been built at Cape Nome, and a refrigerator service established with Seattle and New York, where the meat is regularly served in half a dozen hotels. On the basis of the Alaskan results, Prof. Russell Smith estimates that, with the remainder of North America and Greenland included, an annual output of three to four million animals is within the bounds of possibility.

Scientific Expedition to the Gulf of California.

An account of a recent scientific expedition to the Gulf of California is given by Mr. J. R. Slevin in a paper published in the *Proceedings of the California Academy of Sciences*, 4th Ser., vol. **12**, No. 6, 1923, a reprint of which has been received. The expedition, of which Mr. Slevin was in charge, was sent out by the California Academy of Sciences to replace the collections which were lost in the fire of 1906. The object of the expedition was to make a thorough study of the flora and fauna of the islands in the gulf, and of as much of the adjacent mainland as possible. For this purpose the gasolene schooner *Silver Gate* was chartered, and the expedition left San Pedro, California, on 16 April 1921. Practically every island in the gulf was visited on the way south, and on the way back the most profitable collecting grounds were visited and worked. The expedition ended on July 10, after a cruise of 1,811 miles. Every assistance was received throughout from the Mexican authorities.

The Carlsbad Cavern, New Mexico.

A further area in the United States recently set aside as a national monument is the "Carlsbad Cavern" in New Mexico, the full wonders of which have only lately been brought to light by explorers. It lies 30 miles south-east

of Carlsbad in the eastern foothills of the Guadalupe Mountains, which are composed mainly of limestone, with beds of gypsum and salt. The work of underground streams has produced a striking series of caverns. A visit to them is described by Mr. W. T. Lee in an article in the *National Geographic Magazine*, January 1924, chiefly remarkable for the photographs reproduced. The natural opening is a hole in the roof of the cavern where the rock has fallen to the floor, 170 feet below. This part of the cavern is the home of innumerable bats, and has been worked as a guano deposit. It is through a shaft and apparatus installed for this work that the cavern is entered at present. The actual dimensions of the caves are still uncertain, and an adequate idea of the character of the interior can only be gained from the photographs. It appears, however, that from the foot of the shaft a passage about a mile long, narrowing in places to a width of 100 feet, runs downwards, flanked by lateral caves, with stalagmites and "frozen cascades" on the walls. A chasm has to be negociated, which requires a descent of 150 feet and a climb of 90 feet on the further side. The slope then becomes more pronounced, and the main chambers are finally reached. These are several hundred feet in width, and most are filled with an amazing variety of stalactites, ranging from a few inches to the entire height of the caves, and taking the form of single columns or grouped in curtains; stalagmites are not so numerous. In the "Big Room," on the other hand, the enormous stalagmites are the chief features, many resembling totem-poles in form.

GENERAL

Congress of Slavonic Geographers.

A correspondent informs us that a first Congress of Slavonic Geographers and Ethnologists is to be held at Prague from the 4th to the 8th of this month. Besides supplying a general view of the progress hitherto made in Slavonic geography, the congress will arrange a programme for future work, and will endeavour to ensure continuity by means of a strong organization. An exhibition of Czecho-Slovak and other Slavonic cartography has been arranged. The organizing Committee includes the well-known geographers Professors Svambera, Niederle, and Cvijić, as well as the Director of the State Geological Institute of Czechoslovakia, Prof. Cyril Purkyne.

CORRESPONDENCE

Skeletons from Petra.

My attention has been drawn to certain statements contained in a footnote to Sir Alexander Kennedy's article in the current number of your *Journal* (p. 285), from which it would appear that I have examined five complete skeletons from Petra. I was shown a few lower limb bones and portions of two broken skulls, but no other part of the skeleton, and I declined to express any opinion upon them.

I am not in agreement with the statements attributed to me in the note, and dissociate myself entirely from the ideas therein expressed.

I shall be much obliged if you will be good enough to publish this correction in your *Journal* at the earliest opportunity.

Douglas E. Derry,
Professor of Anatomy.

School of Medicine, Cairo, Egypt,
17 April 1924.

The above letter has been submitted to Sir Alexander Kennedy, who asks us to say that he much regrets the misrepresentation of Professor Derry's opinions in the footnote, which was based entirely on Dr. Dalbey's letter.

ED. *G.J.*

Sunspots and Weather.

On my return from a recent journey to Asia and Australia my attention was called to the *Geographical Journal* for last October containing a review of a book by Dr. Visher and myself on 'Climatic Changes.' At almost the same time a review of my 'Earth and Sun' has come to hand in the February number. It is always in order, I believe, to correct errors in such reviews, and I therefore ask you to print this letter.

The review of 'Climatic Changes' was written in a thoroughly fair-minded spirit, a spirit which I fully appreciate in view of the fact that some of the conclusions set forth in that book are novel and disconcerting even to the authors. Nevertheless the review may lead to a misunderstanding of the position of Dr. Visher and myself in certain respects. For example, it states that according to our solar hypothesis "when the continents were highly emergent, a rapid increase in sunspots resulted in a Great Ice Age. The terrestrial conditions change more slowly than the solar, hence the phenomena of interglacial periods." This seems to suggest that we advocate the hypothesis that a single period of activity of the sun was somehow able to produce both glacial and interglacial epochs. Our actual hypothesis is that during a single period of emergent continents there were a number of epochs of solar activity.

Again, the reviewer states that in 'Climatic Changes' "arguments are adduced which suggest that the sunspots, owing to their effect on storminess, may themselves play a part in the crustal changes, the rapid fluctuations of the barometric pressure acting like the blows of a hammer in fissuring the crust and causing earthquakes." This gives the idea of a degree of violence in atmospheric movements such as we certainly did not intend to convey. Our position is briefly stated as follows: "Apparently earthquakes and crustal movements are somehow related to sudden changes in the load imposed on the Earth's crust by meteorological condition" (p. 306). ". . . It must not be supposed, however, that meteorological conditions are the cause of earthquakes and of movements of the Earth's crust. There is . . . a great difference between the cause and the occasion of a phenomenon" (p. 307). ". . . The force that causes such movements would be the pull of gravity upon the crust surrounding the Earth's shrinking interior" (p. 310). But this hypothesis is "non-essential" and "still so new that only the first steps have been taken in testing it" (p. 314).

Another wrong impression may be gained from the reviewer's statement that "there is a solid impediment to believing that the solar variation is controlled by the 'nearest fixed stars.' How can they be responsible for the eleven-year cycle? And if they do not control the large variation we do see, why make them responsible for a larger variation we are asked to believe in without other reason than the convenience of the argument?" The answer is that nowhere in 'Climatic Changes' is there any hint that the stars cause the eleven-year cycle. Our hypothesis is expressed as follows: "Numerous good thinkers from Wolf (who first prepared the sun-spot numbers) to Schuster have held that the sunspots owe their periodicity to causes outside the sun. The only possible cause seems to be the planets, acting either through gravitation, through forces of an electrical nature, or through some other agency" (p. 61). And on a later page, "This seems to indicate that there is some

truth in the hypothesis that sunspots and other related disturbances of the solar atmosphere owe their periodicity to the varying effects of the planets as they approach and recede from the sun in their eccentric orbits, and as they combine or oppose their effects according to their relative positions. This does not mean that the energy of the solar disturbances is supposed to come from the planets, but merely that their variations act like the throwing of a switch to determine when and how violently the internal forces of the sun shall throw the solar atmosphere into commotion. This hypothesis is by no means new, for in one form or another it has been advocated by Wolfer, Birkeland, E. W. Brown, Schuster, Arctowski, and others" (p. 243).

Only when we had come to the conclusion that the periodicity of sunspots is apparently due to the action of the planets did it occur to us to inquire into any possible relation between climate and the fixed stars. Our reasoning was simply that if the planets affect the sun, the nearer stars, which are vastly larger and hotter than the planets and presumably have far more active atmospheres, may produce equal or greater effects in spite of their far greater distances. The probability of such an effect is increased if Schuster is right in his suggestion that the relation between the planets and the sun may be electrical rather than gravitational.

Turning now to 'Earth and Sun' we find that book reviewed in a spirit wholly different from that animating the review of 'Climatic Changes.' Aside from expressing an almost violent dislike not only for all the conclusions in the book but for all the facts, Mr. Brunt makes five specific criticisms, four of which are unwarranted, while one is warranted but insignificant.

1. The first criticism is this: "Such a well-known solar relation as the sunspot variation with the diurnal range of the horizontal component of the Earth's magnetic field finds no mention." If Mr. Brunt had examined the index, the heading "magnetism" or "terrestrial magnetism" would have led him to a reference to "horizontal intensity." At the top of page 101 he would have read, "The evidence of some kind of electrical or magnetic connection between the Earth and the sun seems conclusive. The best known evidence is perhaps the close correspondence between solar disturbances and perturbations of the magnetic needle." This correspondence is illustrated on page 102 by some curves prepared by Dr. Bauer of the Carnegie Institution of Washington. At the bottom of page 101 it is stated that he bases his magnetic curve on "the average horizontal intensity of terrestrial magnetism for each month modified by the average diurnal range of the same condition."

2. Mr. Brunt criticizes my statement that Humphreys' curves of temperature and sunspots "show clearly that the Earth's temperature rises when sunspots are few and *vice versâ*." He cites 1870 and 1912 as examples of disagreement. The implication is that I have overlooked such disagreements. On the contrary, in the second sentence after the one quoted by the reviewer I quote with approval a statement by Humphreys as to "marked discrepancies from time to time" between the two curves. The next paragraph discusses the cause of these discrepancies and ends with these words: "It appears that when the effect of the seasons and of short fluctuations is eliminated as in Fig. 1, at least four-fifths of the Earth's variations in temperature have been due to changes in the sun." The remaining fifth is ascribed to terrestrial causes among which volcanic dust appears to have been important, especially in 1912, as any careful reader can at once see from the text and diagram.

3. Mr. Brunt criticizes my use of correlation coefficients to determine the possibility of a relationship between a curve showing variations in planetary

movements and the curve of sunspots. "Had the author," he says, "chosen any other curve with a period round about eleven years, then so long as it coincided in phase with the sunspot period near the middle of the range, it would naturally give an appreciable coefficient of correlation with the sunspot curve."

This is perfectly true, but it is in no sense an argument against the possibility of a relationship between sunspots and the planets. The point is that although scores of able investigators have searched high and low they have not yet found *in nature* any curve of obviously non-solar origin that agrees with the sunspots in any such fashion as does the planetary curve. Anybody can make such a curve and fit it to the sunspot curve, but no one appears as yet to have found a natural curve of non-solar origin which agrees with the sunspots more closely than does the planetary curve. Having found that there is a remarkable similarity between the two curves the use of correlation coefficients is merely a convenient method of finding out how closely the curves agree and how likely we should be to find such an agreement among a series of curves selected at random.

4. Another of Mr. Brunt's specific criticisms is as follows: "The author quotes a considerable amount of observational data in some of his tables, but seldom gives references to the source from which they are taken." As a matter of fact, except in the case of the well-known facts as to the periods, sizes, and other conditions of the planets, the text and footnotes state where all the observational data were obtained. It would have been useless to repeat references to Wolf, Wolfer, the Monthly Weather Review, or the Greenwich tables each of the scores of times that sunspots are mentioned.

5. But Mr. Brunt is not always wrong. He is right in saying that in Table 19 a number of meteorological records have been ascribed to Kew instead of Greenwich.

In conclusion, is it not possible that a review which errs in its details in four cases out of five may require some modification in its main conclusions as to the worthlessness of 'Earth and Sun'?

ELLSWORTH HUNTINGTON.

Yale University, New Haven, Conn.,
26 March 1924.

Considerations of space make it impossible to deal fully with Prof. Huntington's replies to the reviews in this *Journal* of his two books. His explanation of points in the first will assist the student to form conclusions on these very debatable subjects. But we are bound to maintain our objection to the hypothesis of stellar influence on sunspots and on the Earth for the reasons concisely given in our review.

When the second book came for review, it seemed well to invite the opinion of a man eminently fitted by academic training and long practical experience of astro-physics and meteorology to form a sound judgment. The result was, as Prof. Huntington says not unfairly, "the expression of an almost violent dislike for all the conclusions. . . ." In this feeling Mr. Brunt is not alone, as may be seen by reference to other reviews of the book in scientific journals. Judgments of what constitutes a valid connection must be based to a large extent on feeling and instinct. Mr. Brunt has sent a reply to the above letter, which is summarized briefly thus: He still cannot find in the statement on page 101 or elsewhere a clear statement of the relationship between magnetism and sunspots; he considers the discordances in 1870 and 1912 fatal to any close connection between sunspots and Earth-temperatures,

especially since the temperatures discussed are for restricted regions of the globe. He maintains his judgment on the argument by correlation coefficients; but admits that the failure to find some important references to authorities blinded him to full references for other data. The question must be left to the judgment of individual readers, and unanimity in so speculative a question is not to be expected. But we should add that a recent publication of the Air Ministry (*Geophysical Memoirs*, No. 20) gives a very remarkable curve showing an undoubted relation between sunspots and the level of Victoria Nyanza, which would have been most useful to Prof. Huntington's argument. ED. *G.J.*

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1923–1924

Twelfth Evening Meeting, 5 May 1924.—The President in the Chair.

ELECTIONS.—The Dowager Lady Buxton; The Lord Biddulph; Bayard Colgate; Thomas Dinesen, V.C.; Thomas Stanley Glover, B.A., SC.; Percy William Haller; The Rev. Robert Hughes, PH.D., D.C.L., B.D.; Prof. Ellsworth Huntington; George Duncan Jack; Dr. N. L. Linebaugh, D.D., LL.D.; C. Gilbert More; Lady Dorothy Hope Morley; Herbert Court Osborne; Captain H. G. Reed; Bernard Joseph Reilly; Edward George Turner; Dr. D. N. Wadia; Edwin Archer Waymark, A.C.I.I.

PAPER: From East to West across Northern Australia. Michael Terry.

Thirteenth Evening Meeting, 19 May 1924.—The President in the Chair.

ELECTIONS.—Frederick Alfred; Major Albert Edward Bennetto, F.Z.S.; Ernest Brocklebank, J.P., F.R.S.A.; Captain Percy Chambers Cabot; Percy Campbell; Hon. Margaret Bruce Chaloner; Captain David H. Cole, M.B.E.; Sergeant Albert Coleman, A.E.C.; William Courtenay; Mrs. Gertrude Hill Cuthbert; Captain N. Douglas-Stephenson, M.C.; Lady Florence M. Downes; Rev. Harold Garner; J. F. Gibbons, M.A.; William Edward Hope, F.R.C.I.; Godfrey Cresswell Hutchinson; Wilfred Irwin; William John Keeling, M.C.; William Henry King; Miss Marie Mackinnon; Gordon Law Morris; Lieut.-Colonel A. Hume Nicholl, C.B.E., F.Z.S.; Miss Gladys Mary Oram; Miss Daisy Pyser; William G. Riley; Major Raymond Henry Raymond Smythies; Miss Violetta Thurstan; Major Chaplin Court Treatt; Mrs. Marion Watson; Lieut.-Colonel Sir Archibald Weigall, K.C.M.G.

PAPER: Through Kufra to Darfur. Ahmed Hassanein Bey.

Seventh Afternoon Meeting, 12 May 1924.—The President in the Chair.

PAPER: The proposed adoption of a Standard Figure of the Earth. Discussion opened by Captain G. T. McCaw.

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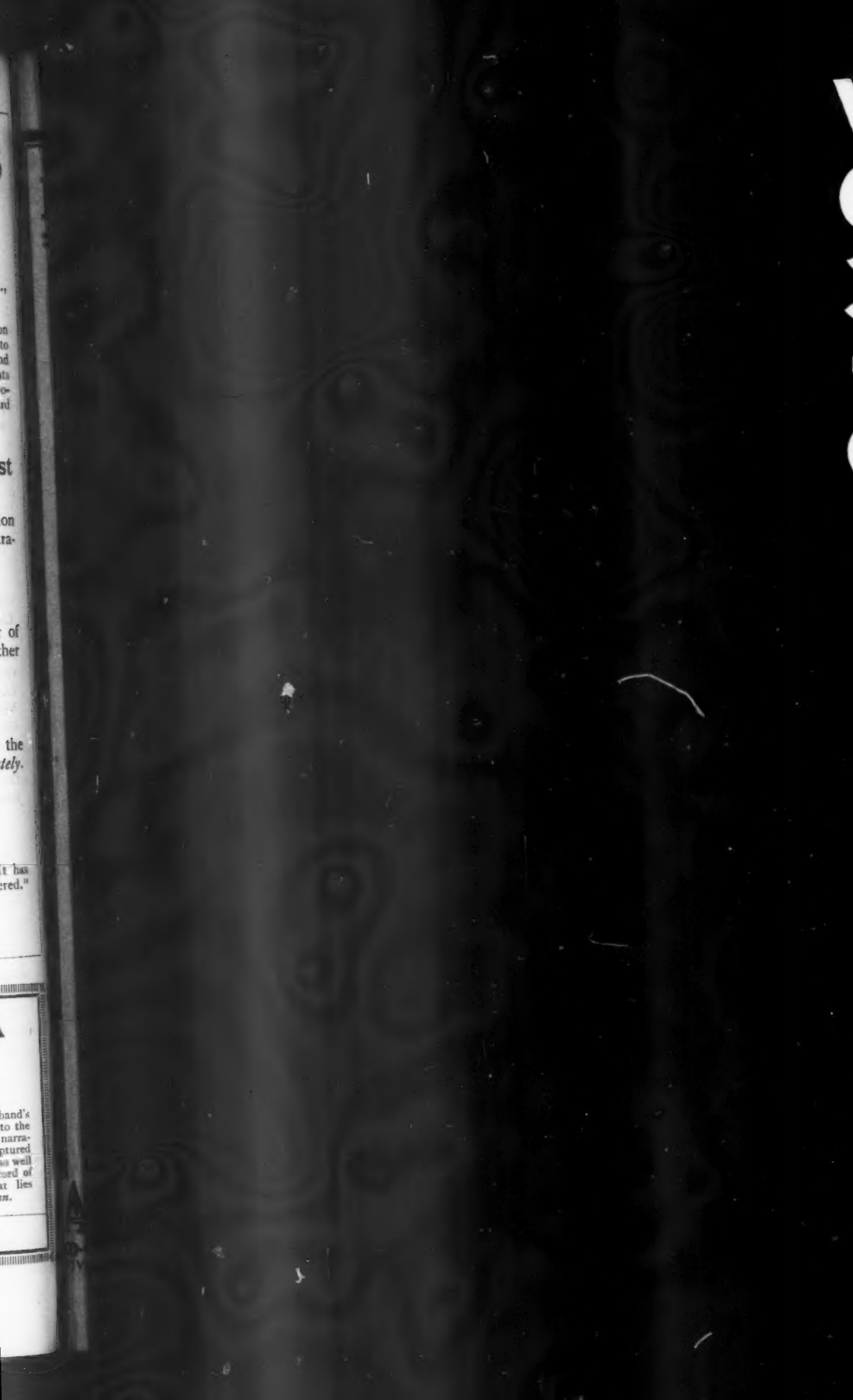

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